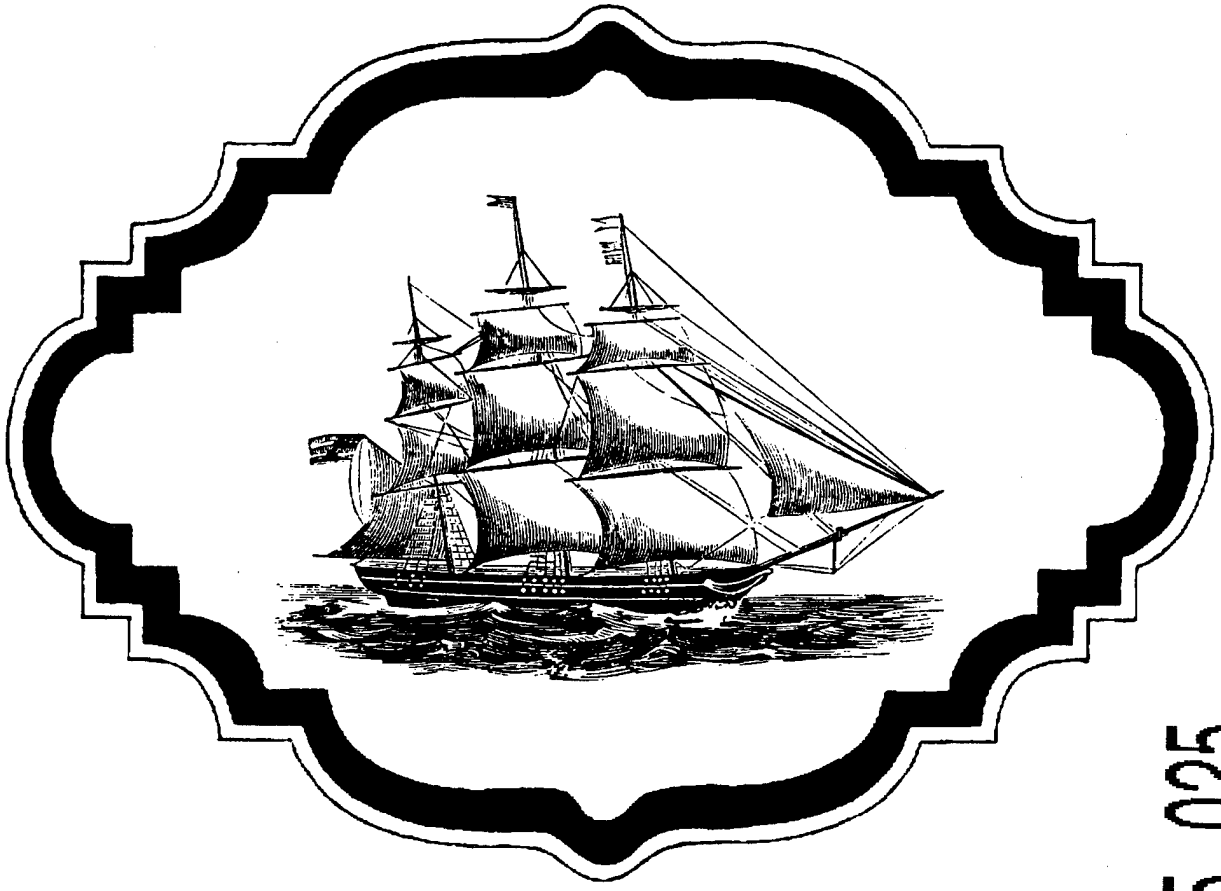
GULF COAST REGION MARITIME TECHNOLOGY CENTER



Quarterly Report

95 - GCRMTC - QR04

October 1, 1995 - December 31, 1995

GULF COAST REGION MARITIME TECHNOLOGY CENTER

QUARTERLY REPORT

95-GCRMTC-QR04

Cooperative Agreement N00014-94-2-0011

REPORT PERIOD: Oct 1, 1995 - Dec 31, 1995

SUBMITTED TO: Mr. Dale Rome
Acting Director
Shipbuilding Technology Office
Carderock Division
Naval Surface Warfare Center

SUBMITTED BY:
Gulf Coast Region Maritime Technology Center
New Orleans, LA

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Gulf Coast Region Maritime Technology Center (GCRMTC) was initiated September 26, 1994 and is now fully operational. The infrastructure buildup consisting of renovation of facilities and initial acquisitions of research equipment, computer hardware and software is nearly complete. The Center has filled all its positions at both sites (Orange Site and New Orleans Site) except for a few project manager positions at the Orange Site. The Center has been designated as a Navy Center of Excellence in Advanced Marine Technology.

Based on Government/Industry Advisory Board recommendations and approval of the Government Program Manager, the Center issued five Requests for Proposals based on five approved Concept (Stage II Problem) Statements. The Center also issued a second call for Concept Statements from the marine industry.

The GCRMTC initiated the Environmental Resources and Information Center (ERIC) June 1995. The Center, which is colocated at the New Orleans Site is a depository and resource for environmental issues of concern to the shipbuilding/marine industries. ERIC is fully operational, and its operations and services are fully detailed on the World Wide Web.

Status reports on 17 collaborative research projects being conducted at both sites are appended for reference. Research projects being conducted at both sites are in collaboration with shipbuilding/marine industry partners.

The Orange Site has completed its Simulation-Based Design facility at Orange, Texas. The Site has initiated several collaborative projects with selected NSRP Panels and shipbuilding/marine industries.

GCRMTC QUARTERLY REPORT
October 1 - December 31, 1995

1. INTRODUCTION

The Gulf Coast Region Maritime Technology Center (GCRMTC) was initiated September 26, 1994 and is now fully operational. The Center has been designated as a Navy Research Center of Excellence in Advanced Marine Technology.

As part of the Center's mission, research is carried out at both the New Orleans Site and its Orange Site. The Center also solicits concept ideas for collaborative research twice a year from maritime industries and then issues Requests for Proposals (RFPs) under the guidance and direction of its Government/Industry Advisory Board (GIAB) and the Government Program Manager. All research sponsored by the Center at both Center Sites and with the marine industries is collaborative research.

2. 1995 MARINE INDUSTRY PROPOSALS

Based on the May 1995 recommendations of the GIAB regarding concept proposals (formerly called Stage II Problem Statements) the Center formulated requests for proposals (RFPs), and obtained the approval of the Government Program Manager (GPM) to issue RFPs in the following five areas:

1. Establishing a Benchmark for Worldwide Marine Machinery and Equipment Manufacturing
2. Automated Machine Learning of Diesel Engine Operating Characteristics
3. An Investigation of the Expansion of the GCRMTC Ships' Reliability, Availability and Maintainability (RAM) database
4. Development of a Portfolio of Ship Designs
5. Automated Off-Line Programming: A Strategic Tool to Link the Design and Manufacturing Processes

Six proposals were submitted and were peer reviewed. The proposals along with Center recommendations and rankings were submitted to the GPM for approval on December 18, 1995. The GPM is reviewing the recommendations and will notify the Center of his decisions. The Center will then negotiate contracts with the individual maritime industries involved.

3. CONCEPT PROPOSAL SOLICITATION

In mid-August, the Center sent out a solicitation for Concept Proposals to over 375 industry and academic sources. Approximately 50 responses were received and processed through an external peer review. The results of the peer reviews along with Center recommendations were presented to the Government/Industry Advisory Board on December 7, 1995. Approved industry Concept Proposals will be converted into RFPs, which will be issued in February 1996. Additionally, research proposals at the New Orleans Site that were approved by the GIAB were converted into full research proposals (in order of priorities and consistent with available funding) and presented to the GPM for final approval and funding. The GPM approved, subject to refinement, internal proposals, both new and continuing projects, on December 22, 1995. The external Concept Proposals are under review by the GPM at present.

A master schedule of events (Appendix A) depicts time frames for both the RFP and Concept Proposal solicitations.

4. GOVERNMENT/INDUSTRY ADVISORY BOARD MEETING

The GIAB met at the Orange Site in Orange, Texas on December 7, 1995. Concept Proposals along with external peer review findings that exceeded a score of 75 or better on the basis of 100 were mailed in advance to GIAB members. All Concept Proposals submitted to the Center were available for the GIAB to review at their leisure. The Center and New Orleans Site presented Concept Proposals, both external and internal, to the GIAB. The New Orleans Site Director briefed the GIAB on the Center findings and the GIAB scored each Concept Proposal. A summary of the results of the scoring was presented to the GIAB at the end of the day.

The GIAB members were taken on a tour of the Orange Site facilities and given a demonstration of the potential of Virtual Reality and Simulation-based Design.

5. INITIATION OF CENTERS

The GCRMTC was originally committed to initiating four Centers — Simulation-Based Design Center, Shipbuilding Environmental Resource Center, Shipbuilding Process and Products Standards Center, and a Marketing Resource Center. Based on the workshop held February 22-23, 1995 it was decided to table the Shipbuilding Process and Products Standards Center. The Simulation-based Design and U.S. Environmental Resource Information Center are fully established. The Marketing Resource Center is in the formative stage at present.

5.1 GCRMTC Environmental Resource Information Center

During the final quarter of 1995, ERIC continued efforts for providing rapid response assistance and workshops on issues involving the shipbuilding industry. The following is a description of the activities and projects:

5.1.1 ERIC's On-Going & Rapid Response Activities

Impact of Anticipated OSHA Hexavalent Chromium Worker Exposure Standard - ERIC personnel participated on the Navy/Industry Task Group studying the technical and economic impact of proposed Occupational Safety and Health Administration (OSHA) reductions in worker exposure levels for hexavalent chromium (Cr(VI)) in preparing a final report. The report provides information on the impact of the proposed OSHA standard on Navy facilities, shipyards, and operations, as well as on the shipbuilding industry that provides weapon systems to the Navy. The Navy/Industry Task Group's primary focus was on the potential for exposing workers to hexavalent chromium particularly during welding, cutting, and grinding of chromium-bearing materials. These operations were initially identified as having the most potential for an economic and technical impact. The necessity of working in enclosed and confined areas is another special concern for Navy facilities and shipyards in particular, and the shipbuilding industry in general. The report was provided to OSHA in response to its request for information on current worker exposure levels for Cr(VI) and on the technical and economic impact of the new standard. The estimates for compliance costs for the lower exposure levels (PEL of 0.5 $\mu g/m^3$) at Navy facilities include an initial, one-time cost of $22,000,000 and an annual cost of about $46,000 per year. The costs for compliance to this PEL for private shipyards are estimated to include an initial, one-time cost of about $9,000,000 and an annual cost of nearly $37,000,000 per year. The costs of reducing the Cr(VI) PEL include training, exposure monitoring, medical surveillance, engineering controls, personnel protective equipment, regulated areas, hygiene facilities, housekeeping, and maintenance of equipment. An abstract of the report can be reviewed on the ERIC electronic bulletin board and is provided as ERIC Information Bulletin 95-01.

TRI-Hazard Value Method (HVM) - The toxic release inventory (TRI) was mandated as a result of the enactment of the Emergency Planning, Community Right-to-Know Act (EPCRA) of 1986, which was Title III of the Superfund Amendments and Reauthorization Act (SARA). Under Title III, industries report information on hazardous chemical releases to the environment to EPA which is known as the toxics release inventory (TRI). The TRI has grown into a significant tool for regulatory agencies and public interest groups for use in assessing toxic chemical releases to the environment and, by inference, for use as a local indicator of environmental quality. However, the comparison of total releases (tons or pounds of releases) based on TRI is often misleading as the comparisons do not take into account toxicity, persistence and bio-accumulation of the individual compounds.

ERIC's staff has developed an approach using a method developed at the University of Tennessee's Center for Clean Products and Clean Technologies (CCPCT) in an EPA study to

rank the chemicals and evaluate the impact on human health and the environment. UNO researchers modified the HVM method proposed by CCPCT to make it work for individual industries. The methodology takes into account the mass of the chemical released, its toxicity, persistence in the environment, and the bio-accumulation in calculating the total hazard value (THV). The THVs calculated using this procedure are better indicators for comparison than the total mass of pollutants. The philosophy used in this approach is to reduce the total hazard rather than the mass of chemical compounds. This methodology has a wider application to rank chemical compounds with respect to reducing the impact on human health and the environment.

Based on the above approach, ERIC developed a computer program that can assist shipyards to rank their chemicals for control. The program is now available for use by the shipyards, and will soon be made available on the Internet for wider accessibility by the interested parties.

Japan's Environmental Regulations - As a result of ERIC and GCRMTC staff's participation in the International Conference on Technologies for Marine Environment Preservation, MARIENV '95, during September 24-29, 1995, information is being collected on international environmental regulations that impact the shipbuilding and repair industry. Through contacts made in Japan during the visit, Japanese environmental regulations in English have been acquired and are being reviewed. They are being compared with U.S. standards with respect to environmental costs and the pollution prevention techniques. Significant interest has been expressed within NSRP SP-1 concerning this effort. An initial paper on this subject is being prepared for presentation at the SNAME/NSRP Ship Production Symposium in San Diego in February, 1996.

This effort is consistent with the GCRMTC's objective to support research that makes the U.S. shipbuilding industry more internationally competitive. These regulations indirectly impact the economics of the industry in the United States.

EPA's Leadership Program - ERIC's staff is currently involved in the new EPA Leadership Program, which involves 15 facilities nation-wide. The Puget Sound Naval Shipyard (PSNS) is one of these facilities. ERIC's staff will be available to assist the PSNS in the promotion of its existing Environmental Management Systems and Pollution Prevention Program.

5.1.2 Educational Programs

ERIC conducted a workshop in November for the local shipbuilding and repair industry to address proposed EPA guidelines for Metal Products and Machinery, and MACT, VOC-Air Toxics Regulations. Members of the Louisiana Department of Environmental Quality provided updates on the proposed regulations and participated in panel discussions. The workshop provided a forum for regulatory and industry representatives to discuss these regulations and exchange ideas. The workshop was co-sponsored by ERIC and the Louisiana Ship Building and Repair Association. Two additional regional workshops are being planned for March 1996, and meetings have been held with industry representatives to identify topics and a more effective approach to improving industry participation. A strong effort will be made to involve the smaller

shipyards in the southeast. A number of specialists have been identified for the development and presentation of workshop material and to work with a Navy/Industry Task Group on an as needed basis.

5.1.3 Visibility, Communications and Industry Participation

Network Development - Mailing lists of all shipyards and repair facilities in Louisiana (96) and in the United States (782) have been developed. Through its contacts with the Louisiana Ship Building and Repair Association and the Offshore Marine Service Association, letters have been sent to this membership explaining ERIC's mission and soliciting their participation in the "ERIC NETWORK." Material for a national mailing is currently being prepared.

Contact is continuing with Navy and Air Force groups for cross referencing military specifications, NSN product codes, Material Safety Data Sheets, and Technical Orders or Bulletins.

ERIC's Internet Page - Development and expansion of the number of environmental data bases which can be accessed on the World Wide Web is ongoing. As previously announced, ERIC's internet address is http://www.uno.edu/~engr/eric.html. The WWW page provides information on ERIC's mission, personnel and e-mail addresses and provides access to the following:

NSRP Committee Project Reports
EPA Pollution Prevention Databases
North Carolina Waste Reduction Database
P-2EDGE (Battelle Northwest)
P2 Library (DOD Sponsored Program to integrate existing P2 databases)
Enviro$ense
LaTAP & UWMRC databases
NDCEE, National Defense Center for Environmental Excellence

Abstracts of GCRMTC projects that address environmental or occupational health and safety issues are being added to ERIC's page. These include statements concerning research objectives, project status and the major findings. A description of the Navy/Industry Task Force on hexavalent chromium has been placed. Other on-going environmental GCRMTC projects will be placed on ERIC's web page shortly. Future informational services are also being planned for the internet. These will include an expansion of the menu to provide current information on ERIC and NSRP SP-1 Panel activities and projects, a condensed description of impending changes in regulatory requirements, and a computerized solution of the TRI/HVM method for shipyards to evaluate their efforts in minimizing the most hazardous wastes.

Regulatory Update - ERIC has subscribed to the Bureau of National Affairs Environmental Library and Environmental Reporter to assist in the identification of regulations and issues that impact the shipbuilding and repair industry. Future efforts will be made to convert this information into a concise form and make it available through bulletins in the ERIC Bulletin Board and in regular mailings to members of the network. ERIC's efforts in this area will

include the smaller shipbuilding and repair yards and subcontractors who are not normally aware of NSRP activities and changes in federal and state regulations.

Newsletter Proposal - ERIC plans to develop a newsletter that will serve large and small shipyards. A proposal was submitted to the NSRP SP-1 Panel in November 1995 to provide a Newsletter as an effective method of disseminating regulatory and technical environmental information developed by the SP-1 projects and activities. The SP-1 Newsletter would be published by ERIC as a service to the SP-1 Panel and the shipbuilding and repair industry. The proposal to SP-1 is discussed further in the following section.

5.1.4 ERIC's NSRP SP-1 Activities

ERIC personnel are actively participating in NSRP's SP-1 and SP-3 Panel meetings. During this quarter, personnel were in attendance in San Diego at the SP-1 and SP-3 meetings in October of 1995. Dr. B. Kura presented a paper, "Prioritization of Emissions for Shipyards Based on the Total Hazard Value" at the National Shipbuilding Research Program (NSRP) SP-1 meeting held in San Diego during October 18-20, 1995. ERIC's staff will also be attending and presenting papers at the SNAME/NSRP Ship Production Symposium in San Diego in February, 1996. Several of ERIC's projects have been found to complement some of the current NSRP projects, and every effort is being made to leverage the products produced.

Draft RFP on PM10 Emission Inventories - NSRP SP-1 is interested in the emission inventories of particulate matter less than 10 micron in size (PM10) resulting from the shipyard operations such as blasting and others. An abstract of a research proposal has been submitted to NSRP SP-1. The proposed research will generate ambient PM10 data and will investigate quantification of emissions using the dispersion models.

DRAFT RFP for Environmental Workshops/Training Road Show - A draft proposal was submitted to Panel SP-1 for an environmental workshops/training road show to facilitate the transfer of the latest environmental information, regulatory and technical, to shipyard operating personnel. Information developed by SP-1 on specific environmental issues will serve as a basis for the workshops and training sessions for the industry. Environmental regulations and technologies continue to change and tend to make it more difficult for the shipbuilding industry to compete in the international market. Information and technology transfer can improve this situation through the use of more efficient operations/processes, and lower emissions, thus minimizing or reducing the costs of environmental compliance.

NSRP Newsletter Proposal - SP-1's Strategic Plans call for an improvement in its visibility and communication between itself and NSRP Panels, ECB, shipyards and beyond. In order to accomplish these objectives, SP-1 desires that a newsletter providing information on their activities be developed. ERIC has submitted a proposal to the NSRP SP-1 Panel in November to produce a newsletter for the panel for the dissemination of panel activities, regulatory and technical environmental information. The newsletter will serve the need for better communications within the industry. Only a small percentage of the shipyards in the US are represented on the panel. A major effort is proposed to provide information to the tier 2

shipyards and other smaller members of the industry. Information on SP-1 projects is available in the form of reports prepared upon completion of a project. These reports are available from NASSCO. It was proposed that a newsletter would be developed that presented current status of panel projects as well as regulatory information. Principal investigators would provide brief status reports which could be included in the newsletter. A draft of the newsletter would be submitted to a small group of panel members (advisory board) for review before distribution. The panel identified an "environmental newsletter" as a priority project idea for FY96.

5.1.5 Work Plan and Activities Proposed for Next Quarter

The proposed activities for the next quarter include:

- Staffing requirements for ERIC's newsletter
- Continue collection of selected reports and documents from, NSRP, EPA, etc.
- Maintain communication and activities with NSRP SP-1 and SP-3 committees
- Develop pollution prevention workshops for shipbuilding and repair industry with the LaTAP; two workshops are planned for March 1996
- Investigate a model for offering workshops in other areas.
- Participation in SNAME/NSRP 1996 Ship Production Symposium and other national/international meetings.
- Support efforts for full investigation of proposed OSHA Standards for reducing the allowable hexavalent chromium levels via air emissions.
- Support in-depth research study (in concert with NAVSEA and private shipyards) to address the issue of the reduced Cr+6 and, also, MnO and N10 emission levels.
- Continue to develop network with local and national associations representing various aspects of the shipbuilding and repair industry (mailing lists, publications, newsletters, industrial advisory board, etc.)

5.2 Simulation-based Design Center (SBDC)

The SBD Center, located at the Orange Site, is fully equipped and operational at present. The Center carries out applied research projects and demonstration projects utilizing Virtual Reality. Activities during the past quarter follow:

5.2.1 Regional

Application of SBD to the LSQC Project (in progress)

The SBDC has received the CAD files for the Brown & Root's design of the LSQC. To date, models have been converted and the mechanical simulation of the proposed design is under development. The project will serve as a demonstration of simulation-based design and the Orange Site capability.

LPD-17 Project Model Visualization (in progress)

As a demonstration of immersive visualization, the SBDC is developing an immersive model of the LPD-17. The product model has been received from NAVSEA and the Center continues to convert it into an immersive environment. The Intergraph workstation from NAVSEA has arrived and is being used for this conversion.

Stern Factory (in process)

McDermott has notified the Orange Site of its intent to issue a subcontract. The New Orleans and Orange Sites have agreed to join forces to implement this project. The Orange Site will provide technical support and services while the New Orleans Site will provide the design and engineering expertise.

5.2.2 Development of SBD Projects

Distributed Collaborative Design -Three projects have been planned.

Shipbuilding Ventures Inc. 40,000 DWT Tanker: The SBDC is hosting an industry intern from Landon and Associates, Inc. who is partnering with Shipbuilding Ventures, Inc. to develop a distributed collaborative design of a 40K DWT Tanker. The geographically dispersed partners on this project will develop this design collaboratively by utilizing the Site's design hardware and software. Additionally, the Center is hosting student interns from Webb Institute who are participating on this project as well.

Distributed Collaborative Design of a 280 foot Cruise Sailing Vessel: The SBDC is rewriting the proposal to submit to ARPA under BAA 96-01. Further the owner, Maritime Preservation, is still looking for a collaborative vehicle under which to design and plan construction for this ship class, and the project partners are still willing to participate. An abstract was sent to ARPA at their request under this BAA and an invitation to proceed with proposal development was extended. This proposal was to develop a vessel design and construction plan for a 280 foot cruise sailing vessel.

5.2.3 Leverage facility resources to benefit education and business

The SBDC has begun dialogue with industry in the following areas:
Collaboration with architectural, engineering, and construction (AEC) industries.

The SGI Regional Manager has agreed to establish a link between the SBDC and AEC industries within the immediate region.

Partnerships to develop Internet services (in development)

Fore Systems, AMOCO, Texas A&M University, and the SBDC have agreed to explore the possibility of providing Internet services in this area to the independent school districts, local businesses, and other interested entities. The plan is to complement existing SBDC resources with the necessary funding to create an extremely high bandwidth connection to the Internet.

6. NEW ORLEANS SITE ACTIVITY REPORT

6.1 In-House Research Projects

Currently there are 12 research projects in various stages of progress. Quarterly reports of these research projects are attached as appendices to this report. An additional two projects have been authorized by the Government Program Manager to commence in January 1996.

GCRMTC Project No.	Title	Appendix
AMTC95-001B	Inexpensive Non-Toxic Pigment Substitute for Chromium in Primer for Aluminum Substrate	B
AMTC95-008A	Integrated Environmental Management Plan for Shipbuilding Facilities	C
AMTC95-010A	Development of High Speed Marine Vehicle Design Database	D
AMTC95-014A	Applications of Integrated Optical Fiber Sensor Systems in Shipbuilding and Shipboard Monitoring	E
AMTC95-016A	Research in Shipboard Sensors	F
AMTC95-018A	Ships' Reliability, Availability, and Maintainability (RAM) Database	G
AMTC95-020A	Performance Simulation of Marine Propulsion Systems under Extreme Conditions	H
AMTC95-023B	Study of Structural Design Procedures in the Shipbuilding Industry	I
AMTC95-027A	Software Applications for Shipbuilding Optimization	J
AMTC95-030A	Improving Technology in the Shipbuilding Industry	K
AMTC95-035A	Digital Image Photogrammetry	L
AMTC95-036A	Predicting Ship Roll Damping	M

6.2 Subcontracted Industry Research (NBDL)

A sub-contract was issued to the Naval Biodynamics Laboratory (NBDL) to carry out a research project, "Motion Sickness and Anti-Motion Sickness Treatment." The status of the project is included in Appendix N.

6.3 Infrastructure Build-up Status

The bulk of the infrastructure equipment directly associated with the first phase of ongoing research projects has been received or has been ordered. Some of the infrastructure equipment planned for the Center/New Orleans Site has been held in abeyance due to uncertainties involving receipt of appropriations.

6.4 Education and Training

The Center hosted an industrial engineering methods training workshop at the University of New Orleans on October 12 and 13. The workshop was sponsored by NSRP Panel SP-8 and was attended by individuals from several area shipyards.

As mentioned in Section 5.1, a workshop co-sponsored by the Center (ERIC) and the Louisiana Shipbuilding and Repair Association took place in New Orleans in early November and dealt with pollution prevention techniques.

7. ORANGE SITE ACTIVITY REPORT

During the fourth quarter, the Orange Site continued its progress toward strengthening its foundation, including revising the Site's business plan, and building toward fulfilling the activities outlined in the GCRMTC mission. During this period, the Site hired three Project Managers who will coordinate the review, award, and management of the SP-9, SP-4, SP-8, SP-5, and SP-6 selected but unfunded projects; solicit and propose projects for funding; and provide technical direction and support.

The Orange Site has received and installed the SGI Power Challenge, a super computer capable of performing high-speed physics-based simulations using finite element analysis and computational fluid dynamics applications software.

The feasibility study to investigate establishing and operating a market analysis and strategic international marketing center has progressed under the leadership of Professor Howard Bunch of the University of Michigan; it is scheduled for completion by the end of April, 1996.

The Site in coordination with others has submitted proposals in response to broad agency announcements. Within the scope of the RFPs, the Site will provide technical and support services, and in one case, overall project management. All of these projects will be directed toward testing and demonstrating aspects of simulation-based design, concurrent and collaborative engineering, and other related technologies.

The Site has started the initial development of several alternative projects. These projects focus on the integration of commercial off-the-shelf technologies, along with testing their functionality relative to the GCRMTC's mission. These projects will involve cooperative arrangements with both commercial and academic institutions.

The following details the Site activities in the last quarter:

7.1 Facilities Enhancement

7.1.1 Hardware

The Orange Site has procured and installed on the network the following hardware platforms:

- 2 Hewlett Packard 9000 series workstations
- 2 DEC Alpha workstations
- 1 Silicon Graphics Onyx Graphics Computer
- 1 Silicon Graphics Power Challenge Computer
- 4 Silicon Graphic Indigo workstations
- 5 Silicon Graphic Indy workstations
- 3 BARCO Stereoscopic Projectors
- 1 Fakespace Boom Immersion Display
- 1 Head Mounted Immersion Display

The Site has also received on loan from Intergraph Corporation a TDZ-400 workstation to be utilized on one of the Site's ongoing projects.

The Site has received from NAVSEA and is currently installing on the network a CAD II workstation for the purpose of data conversion to support visualization of the LPD-17 product model.

7.1.2 Software

The Center's baseline software suite has been procured and installed. See Quarterly Report 95-GCRMTC-QR03. Additional software installed includes Fastship.

Mechanical Simulation:

The mechanical simulation software in use at the Site is ADAMS mechanical simulation software.

7.2 Technology Development

7.2.1 Regional

A Program for Monitoring CPU Usage in a Distributed Computer System Network

This project is being funded out of indirect funds and will be completed by the end of February, 1996. See the attached progress report (Appendix O)

7.2.2 National

Simulation of Outfitting Processes in New Ship Construction (proposed)

The project "Simulation of Outfitting Processes in New Ship Construction", has been submitted for approval. Currently, the project has been reviewed and returned with suggestions for revisions. Avondale Industries has agreed to participate in this project.

The project will focus on four major business units for baseline modeling: machinery, pipe fitting, electrical, and sheet metal. The project will demonstrate current work processes and challenge basic assumptions of the execution of work. Simulation will allow comparing and contrasting of "what if" scenarios to pinpoint developmental areas and opportunities for improvement in the outfitting process in new ship construction. Additionally, it seeks to reduce the risk and cost associated with innovation.

7.3 Testing of Ships, Ship Systems, and Shipbuilding Technology Improvements

7.3.1 Regional

Business Process Improvement Gulf Copper Manufacturing, Inc.(in progress)

See the attached progress report (Appendix P)

7.3.2 National

National Shipbuilding Network (in progress)

The Orange Site has agreed to support development of the National Shipbuilding Network (NSnet) by providing Internet home pages for regional and local marine related businesses. These include shipbuilders, repairers, suppliers, service providers, and port operators. This activity is being undertaken with the assistance of the Orange Site Electronic Commerce Resource Center (ECRC).

One port district and one marine supplier have been added to the World Wide Web as a result of these efforts. At present, the ECRC is working on web pages for another port district and a ship repairer. They now have a person assigned to this activity full-time with the aim of integrating this effort into their overall thrust.

7.4 Education and Training

7.4.1 Regional Area

The Orange Site is providing network services via a T-1 link to the Lamar University - Beaumont Computer Science Department and the College of Engineering. The Computer Science Department is now a part of the Center's network. Efforts are underway to connect the University of New Orleans via a T-1 link; this task should be completed by the end of February, 1996.

7.4.2 National Area

Industry Internship (in progress)

In response to the Orange Site's invitation to the ship design and building community to participate in the sharing and transfer of technology, three interns contracted to Shipbuilding Ventures Inc. and studying at the Webb Institute in New York were placed at the Site to assist in the Visualization of Engine Room and General Arrangement Project. Additionally, these students will develop the canned demonstrations to be used in the GCRMTC / MARITECH booth at the Ship Production Exposition in New Orleans in April, 1996.

Japanese CIMS Translation Project (in progress)

Based on the recommendation of a Japanese translator, a draft of the translated report (and the Japanese version) has been forwarded to Dr. Robert Latorre at the University of New Orleans for his evaluation of a sampling of pages to establish the accuracy of its contents. Additionally, copies have been sent to Dick Moore (U. of Michigan), Bob Schaffran (ARPA), and Howard Bunch (U. of Michigan) for their review and comments. See the attached progress report (Appendix Q).

Sponsorship of NSRP Projects (in process)

NSRP SP9-95-3 "Two Interactive Multimedia Training Modules" is at the contracting stage and is expected to be executed early in the next quarter. All other NSRP Projects are at the request for proposal, review, or refinement phase with the proposed subcontractor. All projects committed for funding by the Orange Site should enter into the contracting stage or be fully executed by the close of the next quarter.

7.5 Marketing Resources

7.5.1 Regional

Ship Repair Market Study (in progress)

See the attached progress report (Appendix R)

7.5.2 National

Market Resource Center Feasibility Study (in progress)

See attached progress report (Appendix S)

8. ACTIVITIES PLANNED FOR NEXT QUARTER

In addition to the future work described in previous paragraphs and in the individual projects in the Appendices, work is planned over the next quarter in the following areas:

1) The Center and Sites will continue to interact with the marine industry on both national and regional levels. Plans include sponsored workshops as well as continued representation at local industry forums and meetings with industry representatives and management. For example, plans have been made to attend the Ship Production Symposium in San Diego in February. The Center will set up and operate a booth incorporating inputs from the GCRMTC, the two sites, ERIC, and the SBDC.

2) Planning will continue for Center and Site participation in the American International Shipbuilding Exposition to be held in New Orleans, Louisiana April 11-13, 1996. Over 6,000 participants from all over the world are expected to attend exhibits and demonstrations from over 165 companies and agencies. We plan to demonstrate simulation-based design technologies utilizing video displays in a synthetic environment.

3) The Orange Site will continue to develop relationships with educational institutions and businesses, both regionally and nationally, to maximize the economic benefit of the technologies available at the Orange Site. Site personnel will continue to meet with representatives of business and educational institutions to discuss partnerships in new research and educational opportunities.

4) The Orange Site will acquire and install the Andrew File System network software to provide redundant file systems in the event of file system down time.

9. SUMMARY

The GCRMTC objectives and milestones as defined by the Cooperative Agreement continue to be met in a timely fashion. The achievements of the two Sites and the Center during the fourth quarter of 1995 were as follows:

1) All staff positions have been filled at the Center and the New Orleans Site and nearly all staff positions have been filled at the Orange Site. The Orange Site is still recruiting project managers.

2) The infrastructure buildup at both Sites and the Center — consisting of renovations of facilities and acquisition of research equipment, computer hardware and software — is nearly complete.

3) ERIC and SBDC are fully operational and actively addressing their respective missions.

4) The Orange Site continues to develop SBD projects and expand its software capability.

5) Research projects were initiated at both Sites and are now fully operational. Status reports of 18 research projects are appended. Each research project is in collaboration with shipbuilding/marine industry partners. Two additional research projects for the New Orleans Site will begin in January 1996.

6) The Orange Site has issued or is issuing RFPs for its commitment to NSRP projects.

7) The Center is awaiting the transfer of appropriated funds from ONR and approval of the GPM to issue subcontracts to several maritime industries who responded to Center RFPs last Fall.

10. RECOMMENDATIONS

Based on a review of the last quarter's activities of the Center and the New Orleans and Orange Sites along with the feedback from the Program Manager and Staff, the following actions are recommended:

1) Upon approval from the Government Program Manager, negotiate and award subcontracts with responders to the July 1995 RFP.

2) Request approval from the Government Program Manager to issue RFP's for Concept Proposals approved at the December GIAB Meeting.

3) Attend and participate in the San Diego SNAME Ship Production Symposium and plan participation in the New Orleans American International Shipbuilding Exposition.

4) Due to uncertainties in future appropriation transfers via ONR the RFP's for external proposals should be issued only once a year instead of twice a year. The timing needs to be adjusted such that we can fund proposals in a timely manner.

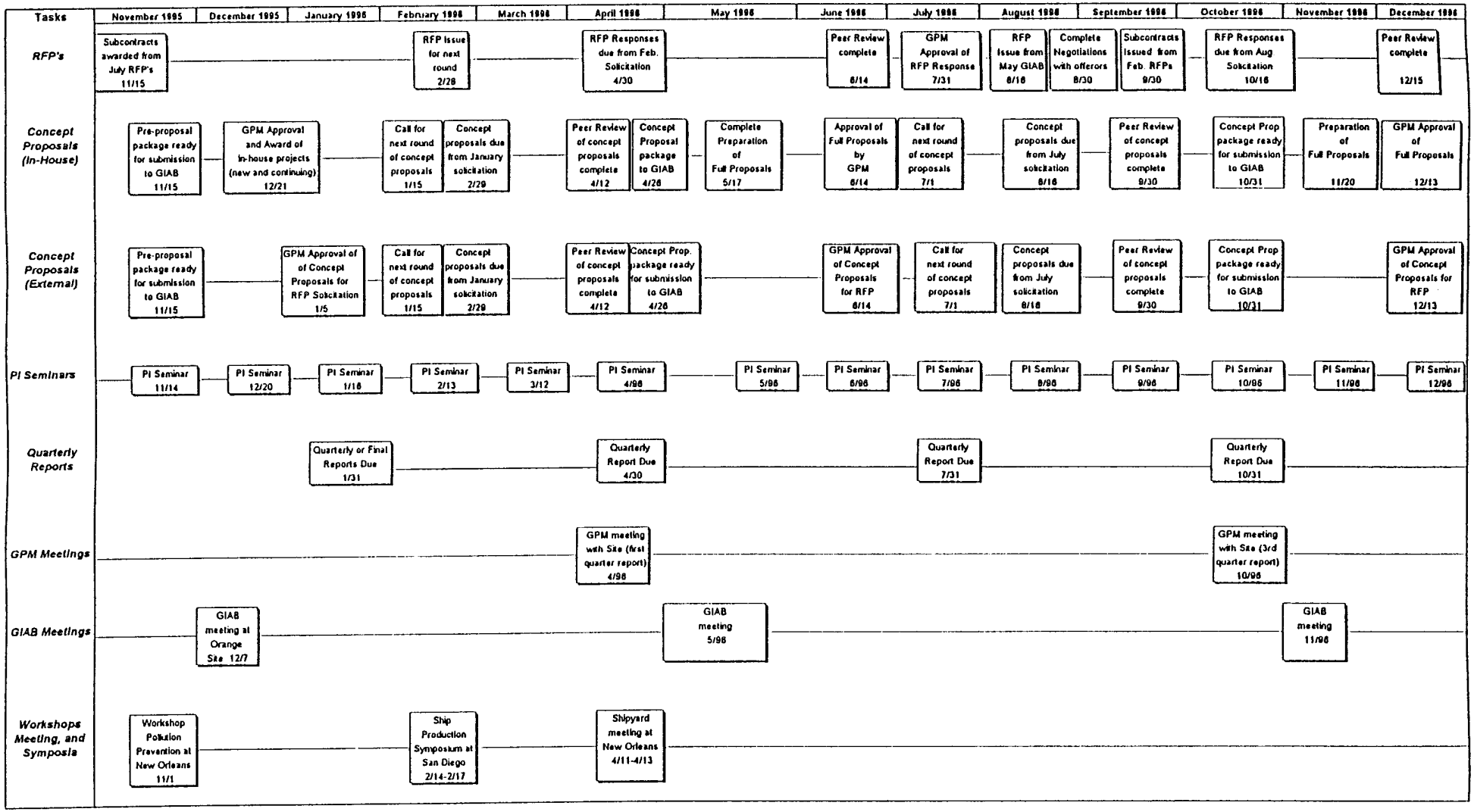
APPENDIX A

GULF COAST REGION MARITIME TECHNOLOGY CENTER

MASTER SCHEDULE

University of New Orleans
New Orleans, LA 70148

Gulf Coast Region Maritime Technology Center and New Orleans Site Master Schedule



GCRMTC-Lamar University Site Program Master Schedule

Name	Earliest Start	Latest Finish	Actual Start	Actual Finish	% Done
Contract Signing	⌘ 10/24/94	1/16/95	10/24/94	10/24/94	100
Core Staffing	10/24/94	5/19/95	10/24/95	❖ 2/24/95	100
Strategic Planning	10/24/94	2/24/95	10/24/95	❖ 12/2/94	100
Technology Specifications	10/24/94	8/8/95	◆ 1/15/95	2/24/95	100
Facility Design	9/12/94	8/8/95	12/5/95	⌘ 3/15/95	100
Major Software	12/5/94	1/23/95	2/27/95	⌘ 8/15/95	100
Major Equipment	12/5/94	12/12/95	2/27/95	⌘ 5/20/95	100
Facility Renovation	12/5/94	12/12/95	3/16/95	⌘ 5/20/95	100
Equipment Installation	12/5/94	9/19/95	3/16/95	⌘ 7/15/95	100
Software Procurement	12/5/94	10/31/95	2/27/95	⌘ 9/15/95	100
Equipment Grooming	1/16/95	12/12/95	7/17/95	⌘ 10/15/95	100
Software Installation	1/16/94	10/31/95	7/17/95	⌘ 10/15/95	100

Key:

⌘ Earliest start equals actual finish

◆ Early start with early finish date

⌘ Late start with early finish date

❖ On-time start with early finish date

Conclusion:

100 percent of program tasks finished on time or early.

GCRMTC-Lamar University Project Master Schedule

Name	Earliest Start	Latest Finish	Actual Start	Actual Finish	% Done
Computer Billing	■ 6/14/95	2/26/96	9/1/95	2/26/96	83
Ship Repair Business	■ 6/15/95	5/31/96	7/1/95	5/31/96	51
Simulation of Outfitting	■ 10/26/95	7/31/97	10/26/96	7/31/97	26
Support of National	□ 7/15/95	7/18/96	7/15/95	7/18/96	20
Translation of Japanese	■ 1/28/95	4/15/96	1/28/95	4/15/96	87
Regional Ship Repair	■ 6/15/95	5/31/96	6/15/96	5/31/96	87
Marketing Resource	□ 7/1/95	4/30/96	7/1/95	4/30/96	80
Maritech Stern Factory	✹ 3/1/96	9/1/96	3/1/96	9/1/96	0

Key:

■ Project proceeding on time according to revised schedule

□ Project proceeding on time according to original schedule

✹ Project to begin next quarter

Conclusion:

Projects are proceeding according to original or revised schedule.

APPENDIX B

INEXPENSIVE NON-TOXIC PIGMENT SUBSTITUTE FOR CHROMIUM IN PRIMER FOR ALUMINUM SUBSTRATE

GCRMTC PROJECT NO. AMTC95-001A

Principal Investigator: **Alfred F. Daech**
Department of Civil and Environmental Engineering

Additional Researcher: **Kenneth L. McManis**
Department of Civil and Environmental Engineering

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: Lithium Carbonate in solution has been shown to protect certain metals, particularly aluminum, from corrosion by reacting at the surface. SIMS (Secondary Ion Mass Spectrometer) confirms this phenomena. Sodium carbonate and potassium carbonate reactions produce a soluble product and no alkali is detected on the surface by SIMS. Because of their high solubility and reactivity most "alkaline metal" compounds are not suitable for corrosion protection. Metallic aluminum normally provides its own corrosion protection due to its tendency to form an aluminum oxide insulator on the surface, but the matrix of hydrated aluminum oxide is penetrated by chemicals such as NaCl, acid and bases.

Engineers and scientists observed that certain aluminum-lithium alloys demonstrated some diffusion of lithium to the surface of the alloy. The lithium ion is so small that it penetrates the large interstitial spaces of the aluminum oxide layer. The aluminum - lithium alloys are stable in chemical composition at ordinary temperatures but a lithium-rich surface can be easily produced in the alloy by briefly heating to facilitate the migration. It appears that certain lithium alloys or compounds can be incorporated into a paint vehicle or otherwise deposited on the surface of aluminum alloys to provide corrosion protection when exposed to salt water, humidity and other corrosive environments.

The corrosion propensity of the various alloys of aluminum may be measured by electrochemical techniques. Electrochemical techniques of corrosion testing have continued to be attractive to investigators interested in corrosion. The imposition of a controlled potential via a potentiostat is a very attractive concept from a reaction kinetics point of view. Furthermore, electrical currents are simple to measure and can be directly related to electrochemical reaction rates through Faraday's Law. AC techniques can be used to determine film resistivity and thickness values. A variety of electrochemical tests have been proposed and developed. Scanning electron microscopy (SEM) and simple magnification of target metals illustrates the surface modification caused by the lithium salts. The problem is to select inhibitors, optimize them and to make them available to protect the aluminum substrates by a coating process.

The United States Navy has established an operations requirement for primers for aluminum which can be applied by personnel while on patrol. The desired product must be a fire retardant, general purpose primer which will be both protective for the exterior as well as the interior surfaces of aluminum. Material selection and usage are rigidly governed by codes; for example, those contained in proposed contaminant restrictions.

Chromium compounds provide outstanding corrosion protection of certain metals. Chromates are used in the chemical conversion coating of Aluminum, (MIL-C-5541). Chromates have reportedly been determined to be carcinogenic and therefore a replacement for them is currently being sought. Environmental Agencies limit the amount of chromium ion tolerated in waste water to less than one part per million. Thus an environmentally benign substitute is desired. Since most available corrosion inhibitors are based on heavy metals or reactive amides, the available alternates appear to fall short of the desired performance in corrosion inhibition and/or environmental suitability.

Various lithium compounds appear to offer a viable alternative to chromium using a new concept of corrosion inhibition.

II. BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$117,386
FUNDS REMAINING	-0-

OBJECTIVES AND SCOPE OF RESEARCH

(A) Objective

One objective of this project is to identify or create new primer inhibitors based on aluminum-lithium to a degree where they will represent a satisfactory substitute for the chromium paints for aluminum.

The second phase objective will be to incorporate this pigment into a paint vehicle which can be used as a primer and which is essentially non-polluting.

The final objective will be to accommodate the products to Navy requirements for various paint specifications where possible and to arrange a manufacturing facility.

(B) Scope

The scope of this project as described is very broad. Obviously one cannot develop a new concept in coatings and follow through to a broad set of specifications and uses in one or two years for a few hundred thousand dollars. However, we will demonstrate that the product can fulfill all of the requirements from the pigment concept to the final use. The pigment will be investigated in detail. The coating will utilize existing vehicles i.e. latexes, etc. used by the Navy under military specifications with chromate pigments. We will then assess the suitability of the developed product to meet existing specifications and propose modifications, inserts, or deletions.

ACCOMPLISHMENTS YEAR TO DATE

The fundamental piece of equipment used in this part of the program is the Model 352/252 Soft Corr™II Corrosion Measurement & Analysis Software manufactured by EG&G Instrument Division of Princeton Applied Research.

The instrument is installed and running. Qualification tests per ASTM G-3 and G-5 were run to ensure proper functioning of the equipment. The first machine was out of calibration and was replaced by the vendor. The recent flood in New Orleans, in May 1995, also lead to some delays since the airport was closed, the motels and hotels were filled with flood victims and those rental cars which were not flooded were rented out to victims. This delayed the technician coming from the factory for thirty days.

The technician determined that the defect was not correctable without major repair. The machine was replaced by the vendor. In the interim, we purchased training films, programs and books and began test runs and procedure trials.

A series of chemicals were selected and purchased for the compounds tests. Substrate aluminum panels were selected and purchased. Some aluminum-lithium compounds have been ordered and others will be chosen as time allows. Some vendors are reluctant to send certain aluminum-lithium products because they are considered proprietary.

The American Conference of Governmental Industrial Hygienists in their 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices does not list lithium compounds as a particular problem although the subject has been studied in connection with batteries, ceramics and as an absorber of atomic particles in nuclear reactors. Only Lithium Hydride is listed on the TLV list. The Material Safety Data Sheet reports that Lithium Citrate is stable, has no hazardous reactivity, and is not carcinogenic, but is considered toxic by ingestion, injection and inhalation.

Generally, the lithium compounds are not considered poisonous, depending on the anion. Lithium Hydride, Lithium Hydroxide, Lithium Fluoride, Chloride and Lithium Selenate, to name a few are toxic, largely due to the toxicity of the anions. Lithium is a common element and many of its salts, i.e., acetate, benzoate, borate, carbonate, lactate, nitrate and sulfate are commercially available and regarded as moderately toxic. The overall toxicity will be determined when the final formula is selected. The paint vehicles will be selected from those which are environmentally acceptable.

We are now members of the SP-3 committee of the Steel Structures Painting Council (SSPC). This group is involved in surface preparation and painting of ships. As the name suggest the prime problem is steel, however all members contacted have aluminum corrosion as well as steel. The members include military and commercial builders. The large commercial ships are concerned primarily with steel hulls and structures.

Aluminum-Lithium powder is the fundamental material studied in this project. It is available from many other sources but most require orders of substantial quantities. One source confirmed that patents being sought by manufacturers create some limits. The material is commercially available but quantities limit the variety, since a minimum purchase can be $5,000 to $10,000 worth of material. However, enough is available to complete the study.

Discussion of Results

The first year's schedule has slipped in some task areas due to the flood and the defective equipment, which could not be corrected until the factory representative arrived to verify the problem.

(1) Contact Suppliers by Phone

We have contacted Doctor Alex Chou of Reynolds who has agreed to send us the version of Aluminum-Lithium proposed for use on the Space Shuttle. Comalco (Australia) has supplied a sample of high lithium content alloy. Alcoa has offered to sell sheets of alloy 2090, but the price and quantity is excessive.

The Aluminum Powder Company Limited in England unofficially suggested a price of $8/lb in large quantity, but for 150/lb. minimum the price is about $40/lb. We are negotiating to get smaller quantities at a better price. International Nickel, Pichonet, Kaiser, Alcan and International Light Metals have not yet agreed to participate.

(2) Perform Survey of Similar Studies

The only study found in references was the study by R.G. Buchheit of Sandia and Jing Gui and M.T. Douine (University of California, Berkley). It appears that they are working on the "Anodize" or "Irridite" approach. Buchheit has sent his papers to us and the literature study has given us published work to date by the University of California. The formation of "talc" if it occurs, is probably not the source of our corrosion resistance since no carbonate is used. The literature search is complete. Although many references to lithium were found, only Buchheit and Associates propose a lithium corrosion inhibitor.

(3) Study Literature

The pertinent papers from the literature survey have been received and all but two or three of sixty are on file and have been studied. This will be periodically updated but is essentially complete.

(4) Order Any Other Promising Inhibitors

Many of these chemicals are on hand and will be disclosed as they are tested.

(5) Prepare Screening Tests

The first screening tests have been performed on pure aluminum panels. We will look at passivation by combinations of inhibitors. 5,000 and 2,000 series were checked to look at alloying effects on the aluminum corrosion properties as related to the passivity produced by the lithium and its salts. Alloys 1100, 2219,5052 and 6061 were passivated.

(6) Perform Rating by Electrochemistry

A statistical series was started to determine the type and quantity of passivators to be used. The layout of the series is four lithium salts at four levels. The series has sixteen combinations each representing combinations of passivators. This enables us to get data equivalent to four to the fourth power or 256 experiments. (See Appendix A). The pH for the first set was maintained at 10.5. Another set will be run at Ph 9.0. Other passivators will also be run. The passivators are compared on the curves by the degree of passivation and the quality of the exposed panels (i.e. deposition of protective coating and lack of corrosion.)

The two month delay due to floods and defective equipment has shifted this work from 4th. Quarter 1995 through 1st. Quarter 1996 to 1st. Quarter 96 through 2nd. Quarter 96. Once the optimum combination of inhibitors has been established the Aluminum-Lithium pigment will be treated so as to provide the desired ratio to the substrate when coated and thus passivate the painted substrate.

The statistical series is now underway and as the sets of curves indicate the wide range of curves promises a good result. Appendix A provides an explanation of the Greco-Latin Squares and one set of curves representing each passivator at a fixed concentration in combinations with every level of other passivators. The result optimizes the passivator combinations based on the ratings of the individual results. The curves should stabilize at zero amperes of current. If there is no current there is no corrosion. There are some circumstances where the current when stable at some value (indicated by a horizontal line on the curve) can represent passivation. A detailed evaluation will be presented in the first or second quarter of 1996.

(7) Treat Pigments

We cannot treat pigments until an argon oven is functional so that we can check the results. This also will be reported in the next quarter.

(8) Analyze Lithium Salts & Metals

A study was made of promising materials on hand. Corrosion inhibitors were selected. The results are encouraging. Lithium Citrate looks particularly good. Since no carbonate is available in the test, the formation of "talc" does not occur. The solution is ultra pure water with nitrogen purge. The passivity appears superior to lithium carbonate but the exact compound formed at the surface has not been determined. Several analyses remain to be performed.

(9) General

Four significant developments resulted from the first year investigations. First, several inhibitors in the form of lithium salts seem to show promise. "Lithium Citrate" looks particularly good possibly from the three lithium atoms in the molecule and possibly because of the citrate. Lithium Nitrate also looks good. Since all carbon dioxide was flushed out of the water and certified ultra pure water, with no carbonate, was used, the formation of "Talcite" coating described in U.S. Patent 5,266,356 does not seem probable with these inhibitors. It appears more likely that Lithium Alumnate (inert ceramic) or some other reactant or structure is probable. Investigations will continue into 1996.

In any event, the passivation was verified on aluminum alloys 1100, 2024, 2219, 5052, and 6061. The 2219 showed a unique second peak which also passivated. This may be pitting corrosion.

The second innovation is called "Nanostructural Inhibitors." The ratio of atoms on the surface to the body of a typical tiny pigment particle is about 1:10,000. If we heat Aluminum Lithium to 300 C, the Lithium migrates to the surface. This is done under Argon and although the Lithium is only 2 or 3% by weight, the surface collects about 90% Lithium. This should improve the corrosion resistance of the alloy and provide surface sites for reacting citrate, etc.

Typical structures painted 20 or more years ago with chrome or lead pigments retain their color if cut, indicating that surface inhibitors may be effective and that much of the inhibitor is not consumed, and usually not necessary.

Thirdly, since heating in argon, the Lithium tends to migrate to the surface of the Aluminum-Lithium alloy, properties such as fracture toughness, and weldability should be improved. This will be a separate investigation. The lightweight of the Aluminum Lithium alloy is desirable but the fracture properties and welding present problems. The relocation of lithium to the surface should enhance corrosion resistance, improve fracture properties and simplify welding.

The fourth thrust is a statistical study of the inhibitors. It seems that there are advantages in blending inhibitors. These salts are particularly adaptable to statistical analyses since they are compatible with one another. Greco Latin Squares are presently being used. Taguchi methods may be used later. Typical results are in the attached Appendix A.

Dr. Nikhil Sarkar has been used as a consultant as planned in the first year. He has twenty-five years experience in electro-chemistry work and is enthusiastic about the results.

PROPOSED ACTIVITIES NEXT PERIOD

(1) Continuing Pigments

The fundamental goal is to find the optimum pigments. Many possibilities exist. Experimental data will be continuously gathered.

(2) Argon Oven

An Argon Oven will be used to generate Lithium-rich surfaces.

(3) Surface Analyses

Surfaces will be analyzed to verify the results. Various reactants will be added to the lithium at the surface. Scanning Electron Microscopy will be employed on surfaces.

(4) Formulate Simple Paint

Pigments will be produced in the Argon oven with subsequent reactions on the surface. A simple latex paint will be made and extensive tests at Euronavy USA will be planned with Navy coordination.

(5) Reports

Reports will be prepared as indicated on the schedule.

COLLABORATIVE EFFORTS:	THIS QTR.	YTD.
$ VALUES OF SERVICES FROM INDUSTRY:		NONE
IN KIND SERVICES:		NONE
ACTUAL FUNDS:		
EURO NAVY WILL TEST PIGMENTS THIS YEAR:	EST.	$50,000
$ VALUES OF SERVICES FROM GOVERNMENT		0
IN KIND SERVICES:		
ACTUAL FUNDS:		
# OF SIGNIFICANT CONTACTS:		
INDUSTRY	3	11
ACADEMIC	1	6
GOVERNMENT	1	5

APPENDIX A STATISTICAL SERIES

(1) Four chemicals were selected for the first series:

SOLUBILITY	FORMULA WEIGHT	CHEMICAL COMPOUND	
0.2M	73.89	A=Li_2CO_3	Lithium Carbonate
0.26M	281.99	B=$Li_3CO_6H_5O_7.4HaO$	Lithium Citrate
1.3M	68.95	C=$LiN0_3$	Lithium Nitrate
Very Sol.	173.82	D=Li_2MoO_4	Lithium Molybdate

(2) The various subscripts indicate variations in molar concentrations: (Moles/liter)

$A_1 = 0$	$B_1 = 0$	$C_1 = 0$	$D_1 = 0$
$A_2 = 0.018$	$B_2 = 0.09$	$C_2 = 0.09$	$D_2 = 0.01$
$A_3 = 0.03$	$B_3 = 0.15$	$C_3 = 0.15$	$D_3 = 0.02$
$A_4 = 0.05$	$B_4 = 0.25$	$C_4 = 0.25$	$D_4 = 0.03$

(3) Sixteen solutions were prepared blending the above:

$A_1 B_1 C_1 D_1$	$A_2 B_1 C_2 D_2$	$A_3 B_1 C_3 D_3$	$A_4 B_1 C_4 D_4$
$A_1 B_2 C_4 D_2$	$A_2 B_2 C_1 D_3$	$A_3 B_2 C_2 D_4$	$A_4 B_2 C_3 D_1$
$A_1 B_3 C_3 D_3$	$A_2 B_3 C_4 D_4$	$A_3 B_3 C_1 D_1$	$A_4 B_3 C_2 D_2$
$A_1 B_4 C_2 D_4$	$A_2 B_4 C_3 D_1$	$A_3 B_4 C_4 D_2$	$A_4 B_4 C_1 D_3$

(4) The table is laid out so that if one rates the solutions as to their ability to passivate, to form a film and to prevent corrosion by pitting or surface corrosion. Each solution will have a numerical value representing the desirability and function of the solution as a passivator.

(5) The aluminum used in the test was 6061T6 and the pH was adjusted to 10.5 with LiOH or HNO_3.

(6) If one adds up the values in the vertical columns all A_1's are in column #1; all A_2's are in column #2; all A_3's are in column #3; all A_4's are in column #4.

A_1---	A_2---	A_3---	A_4---
A_1---	A_2---	A_3---	A_4---
A_1---	A_2---	A_3---	A_4---
A_1---	A_2---	A_3---	A_4---

(7) Furthermore each column pairs the particular concentration of A, i.e. 1,2,3,4 with every value of B, C, and D once and only once.

(8) By adding the values assigned to each solution we can determine which value of A provides the best passivation.

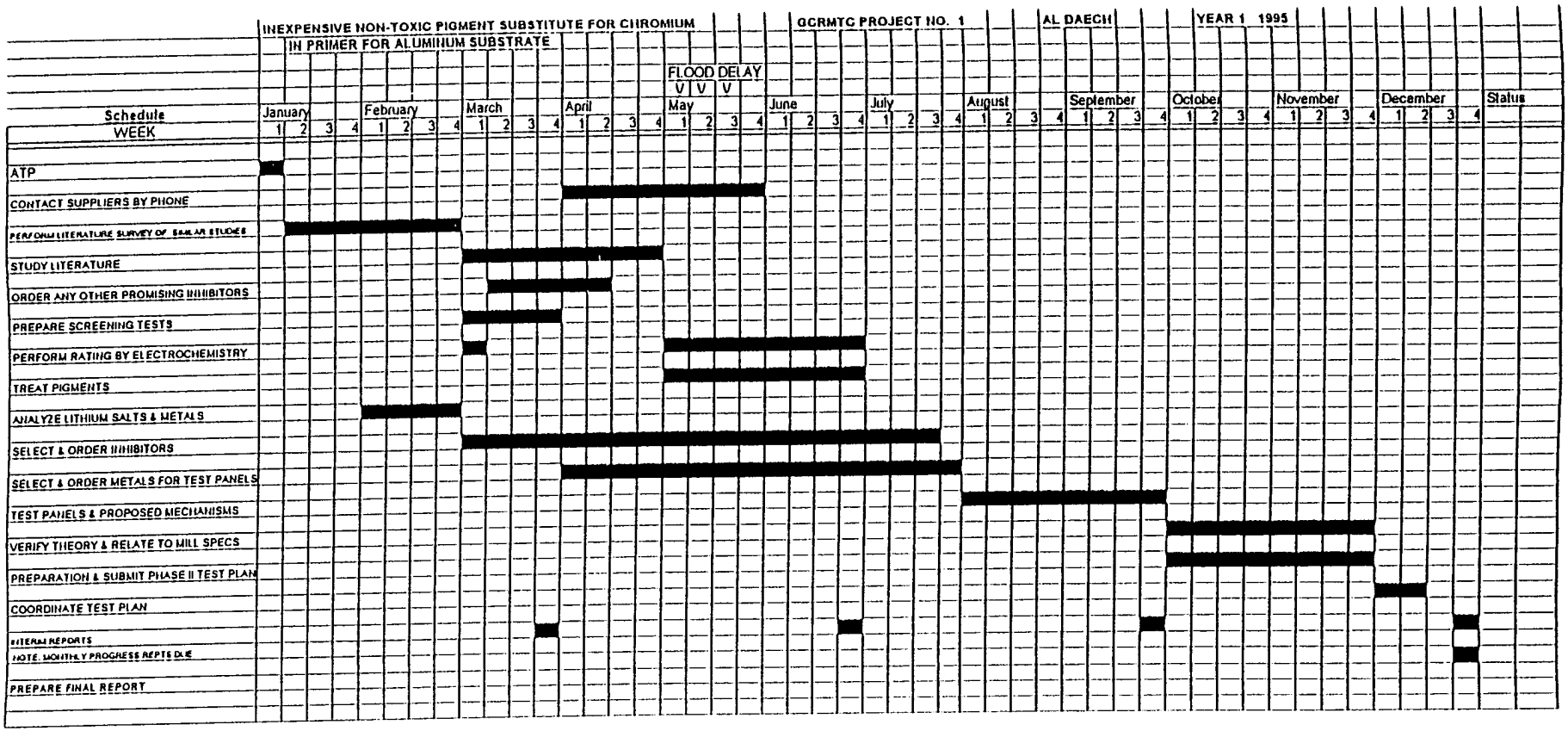
(9) By adding horizontal rows values of B may be evaluated in the same way.

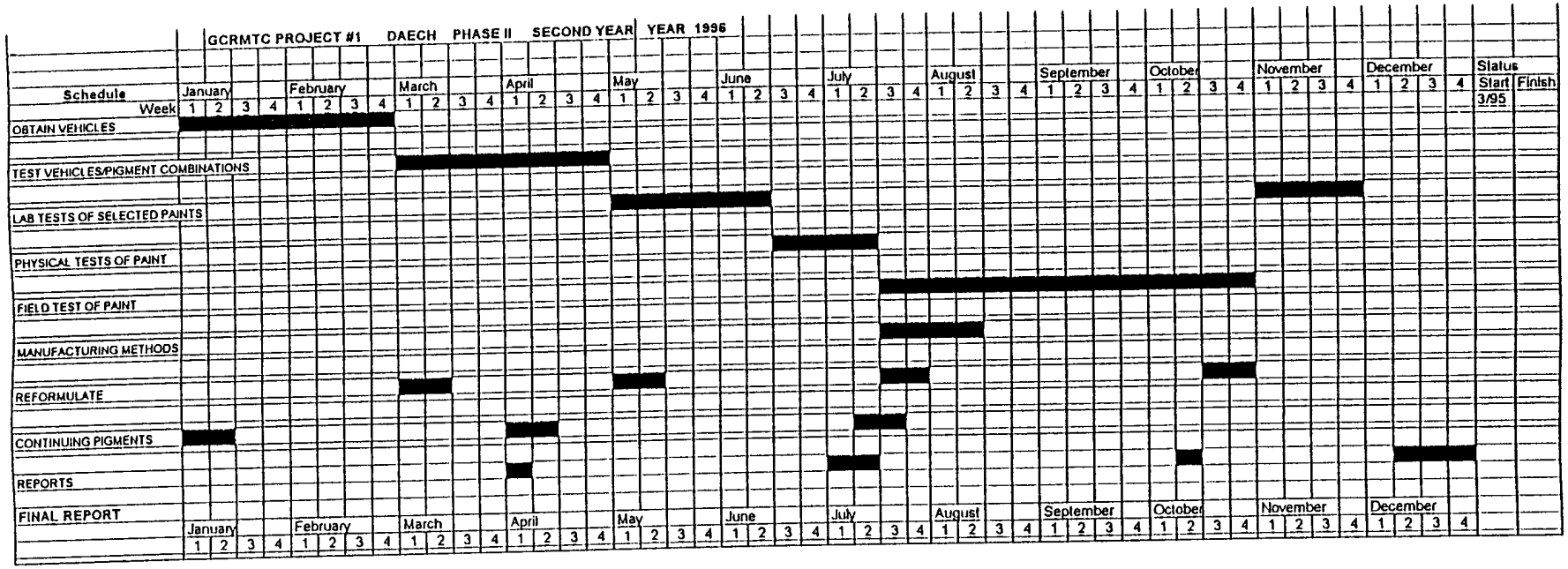
(10) By adding diagonally upper left to lower right, C may be evaluated.*

(11) By adding diagonally upper right to lower left, D may be evaluated.*

* In order to complete diagonals an identical matrix is imposed to the left or right of the original matrix.

One final note there most be no chemical reaction between A, B, C, or D for this procedure to be valid.


INEXPENSIVE NON-TOXIC PIGMENT SUBSTITUTE FOR CHROMIUM
IN PRIMER FOR ALUMINUM SUBSTRATE
GCRMTC PROJECT NO. 1
AL DAECH
YEAR 1 1995
FLOOD DELAY
Schedule
WEEK
January
February
March
April
May
June
July
August
September
October
November
December
Status
ATP
CONTACT SUPPLIERS BY PHONE
PERFORM LITERATURE SURVEY OF SIMILAR STUDIES
STUDY LITERATURE
ORDER ANY OTHER PROMISING INHIBITORS
PREPARE SCREENING TESTS
PERFORM RATING BY ELECTROCHEMISTRY
TREAT PIGMENTS
ANALYZE LITHIUM SALTS & METALS
SELECT & ORDER INHIBITORS
SELECT & ORDER METALS FOR TEST PANELS
TEST PANELS & PROPOSED MECHANISMS
VERIFY THEORY & RELATE TO MILL SPECS
PREPARATION & SUBMIT PHASE II TEST PLAN
COORDINATE TEST PLAN
INTERIM REPORTS
NOTE: MONTHLY PROGRESS REPTS DUE
PREPARE FINAL REPORT


GCRMTC PROJECT #1 DAECH PHASE II SECOND YEAR YEAR 1996
Schedule
Week
January
February
March
April
May
June
July
August
September
October
November
December
Status
Start
Finish
3/95
OBTAIN VEHICLES
TEST VEHICLES/PIGMENT COMBINATIONS
LAB TESTS OF SELECTED PAINTS
PHYSICAL TESTS OF PAINT
FIELD TEST OF PAINT
MANUFACTURING METHODS
REFORMULATE
CONTINUING PIGMENTS
REPORTS
FINAL REPORT

APPENDIX C

INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN FOR SHIPBUILDING FACILITIES

GCRMTC PROJECT NO. AMTC95-008A

Principal Investigator: **Bhaskar Kura**
Department of Civil & Environmental Engineering

Additional Investigator: **Enrique La Motta**
Department of Civil & Environmental Engineering

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: This project is aimed at developing an integrated environmental management plan for shipbuilding facilities that includes source reduction (waste minimization at the source), recycling, treatment and disposal. To achieve the research objectives, Avondale Shipyard will be closely studied with data collection from other sources on activities that are not common to Avondale. The project duration is three years with completion reports at the end of each year. The final product will contain two reports, a specific Environmental Management Plan (EMP) report to serve Avondale and a generic EMP report to serve the shipbuilding industry in general.

The main components of the study are process review, identification of sources of pollution, quantification of pollutants (in solid, water and air streams), impact evaluation, review recycling/ treatment alternatives, study disposal alternatives and regulatory compliance. The first year activities include a study of sources of pollution, emission quantification and some progress on characterization of waste streams and a review of current pollution management practices.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$ 159,380
FUNDS REMAINING:	$ 65,000

NOTE: This project received its funding approval in the beginning of June 1995, rather than the usual start date of January.

ACCOMPLISHMENTS YEAR TO DATE:

According to the proposal the following five tasks were to be completed (in full or partially) in the first year which ends on May 31, 1996. A discussion on these tasks and the work completed is presented below:

Task 1: Literature Review

Accomplishments during October - December 1995

- This task was completed in December 1995. Previously collected generic shipyard information was reviewed and compared with Avondale data. Additional documents will be reviewed further as needed. Also, new literature as published or developed will be reviewed.

Prior Accomplishments

- Available information from EPA sources, NSRP SP-1, University of Michigan was collected and reviewed. Other published and non-published

information from various sources was reviewed. The collected information related to shipyard processes, waste emissions, currently practiced environmental management procedures, and pollution control options.

Task 2: Identification of Waste Streams through Field Visits

Accomplishments during October - December 1995

- This activity was completed in December 1995. Field surveys were conducted at Avondale Shipyard to identify the waste streams. Additionally, the National Shipbuilding and Steel Company (NASSCO) was visited in October 1995 to obtain generic information on waste streams. Future visits to Avondale and other shipyards will complement the information that is being compiled now. Figure 1 gives typical details of shipyard processes and emissions of wastes / pollutants.

Prior Accomplishments

- Several field visits were made to Avondale Shipyard to identify the sources of waste generation and the waste streams. Field surveys provided information on sources of wastewater, air emissions and solid/hazardous wastes.
- Individual shop surveys were initiated after a questionnaire was sent to various shops at Avondale Shipyard. Individual shops contacted included paint shops, blast houses, machine shops, pipe shops, insulation departments etc.

Task 3: Quantification of Wastes (Solid, Liquid and Air Emissions)

Accomplishments during October - December 1995

- This task is still under progress and is expected to be completed by May 1996. Work completed until now includes, a review of quantification methods available from AP-42 documents and other EPA methods. Quantification methods for VOC emissions and particulates in air streams were completed. These methods are being applied to specific shipyard sources/processes. Similarly, waste surveys being conducted at Avondale will be useful in assessing the quantities of solid and liquid wastes.

Prior Accomplishments

- Documents required for quantification of wastes from EPA and NSRP-SP1 sources were identified and procured for the project use.

Task 4: Characterization of Waste Streams

Accomplishments during October - December 1995

- This activity was originally planned to cover 18 months from the beginning of the project. First year activities included characterization of air streams. Two important categories of air pollutants in shipyards are particulates (total particulates and particulates less than 10 micron (PM10)) and volatile

organic compounds (VOCs) most of which are hazardous air pollutants (HAPs). Available information was reviewed for the project. For field investigations, a particulate analyzer capable of measuring ambient particulates and particulate emissions from various sources was selected for purchase. This equipment with accessories will be received in January 1996. Field work will commence in February 1996 for characterizing the particulates with size distribution. Similarly, analyzers for VOCs are being reviewed for purchase and will be used to complete the task.

Prior Accomplishments

- This task was not initiated until the beginning of the quarter, October - December 1995.

Task 5: Review of Existing Waste Management Techniques

Accomplishments during October - December 1995

- This activity is partially completed through the field visits to Avondale. Additional information from other shipyards will be collected in future. This activity was originally planned to be completed in 18 months from the beginning of the project.

Prior Accomplishments

- This task was not initiated until the beginning of the quarter, October - December 1995.

Other Accomplishment during October - December 1995

- Presented papers at various technical meetings on topics that are relevant to shipbuilding and environmental management. Details of these presentations are discussed below:

<u>Presentations at the Technical Meetings / Conferences</u>

Presented two technical papers at the "5th Annual Conference & Technical Exhibition" held in Lafayette, Louisiana on October 7, 1995. The conference was organized by the American Society of Environmental Sciences. Details of the papers presented are:

1. Environmental Assessments of Shipyards
   Author: Bhaskar Kura
2. Comparative Risk Analysis of the TRI Data as an environmental Indicator - A Louisiana Case Study
   Authors: W. Reid Lea, Bhaskar Kura

Presented a paper on "Prioritization of Emissions for Shipyards Based on the Total Hazard Value" at NSRP SP-1 Meeting held in San Diego during October 18-20, 1995.

Presented a total of six papers at "Society of Engineering Science's 32nd Annual Technical Meeting" held in New Orleans organized by UNO and Tulane University. Titles and authors of these papers are:

1. VOC Emissions from Surface Coating in Shipbuilding and Ship Repair Industry and Control Options
Authors: Bhaskar Kura, Raghuram Tadimalla

2. PM10 Emission Inventories for Blasting in Shipbuilding Industry, Regulations and Control Options
Authors: Bhaskar Kura, Satyanarayana Dwivedula

3. In-Situ Bioremediation for Oil Spill Management Using Enzyme Products
Authors: Bhaskar Kura

4. Comprehensive TAP Emission Control Program in Louisiana
Authors: Bhaskar Kura, W. Reid Lea

5. Typical Waste Streams in A Shipbuilding Facility
Authors: Bhaskar Kura

6. MRPF Technology for Management of Organic Pollution of Coastal and Bay Waters
Authors: Bhaskar Kura, Kenneth L. McManis

PROPOSED ACTIVITIES NEXT PERIOD:

1. Follow up meetings with shop supervisors at Avondale.
2. Additional waste surveys at Avondale Shipyards.
3. Initiate field measurements at Avondale.
4. Review the equipment for VOC analyzer.
5. Develop the format for Year 1 Completion Report.

COLLABORATIVE EFFORTS	**THIS QTR**	**YTD**
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:	15,600[a]	30,900
ACTUAL FUNDS:		
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:		
ACTUAL FUNDS:		

No. OF SIGNIFICANT CONTACTS:		
INDUSTRY:	5[b]	25
ACADEMIC:	0[c]	2
GOVERNMENT:	2[d]	6

COMMENTS:

[a] Includes the cost of the man-hours by Avondale staff during field visits, number of hours spent by Avondale staff in providing information, cost of photocopies provided etc. A total of $15,000 accounted toward one man-month time of Avondale personnel and an amount of $600 toward the cost of photocopies provided.

[b] Includes personnel at Avondale Shipyard and other shipyards in Louisiana.

[c] None this quarter

[d] Personnel at DEQ office in Louisiana.

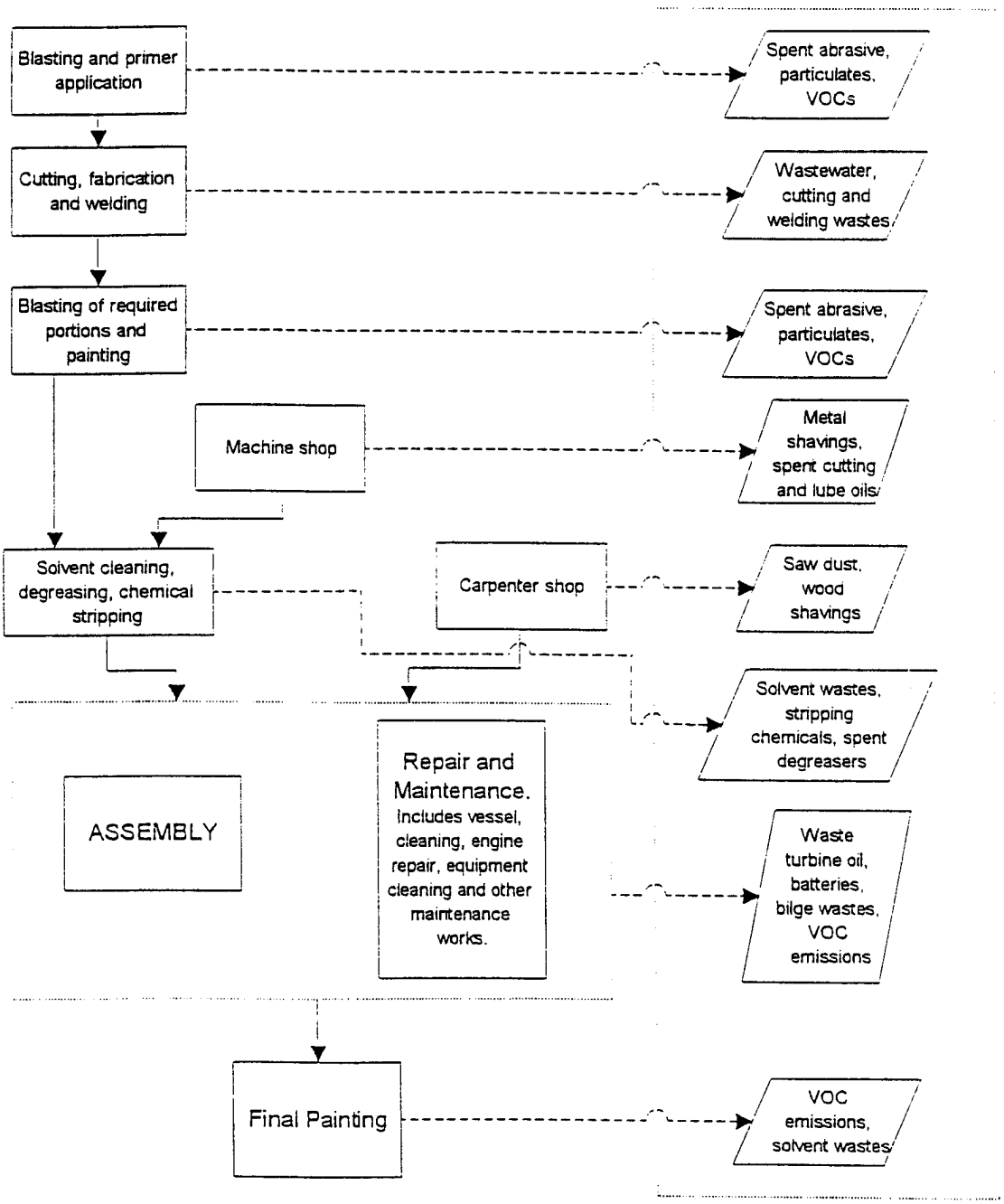
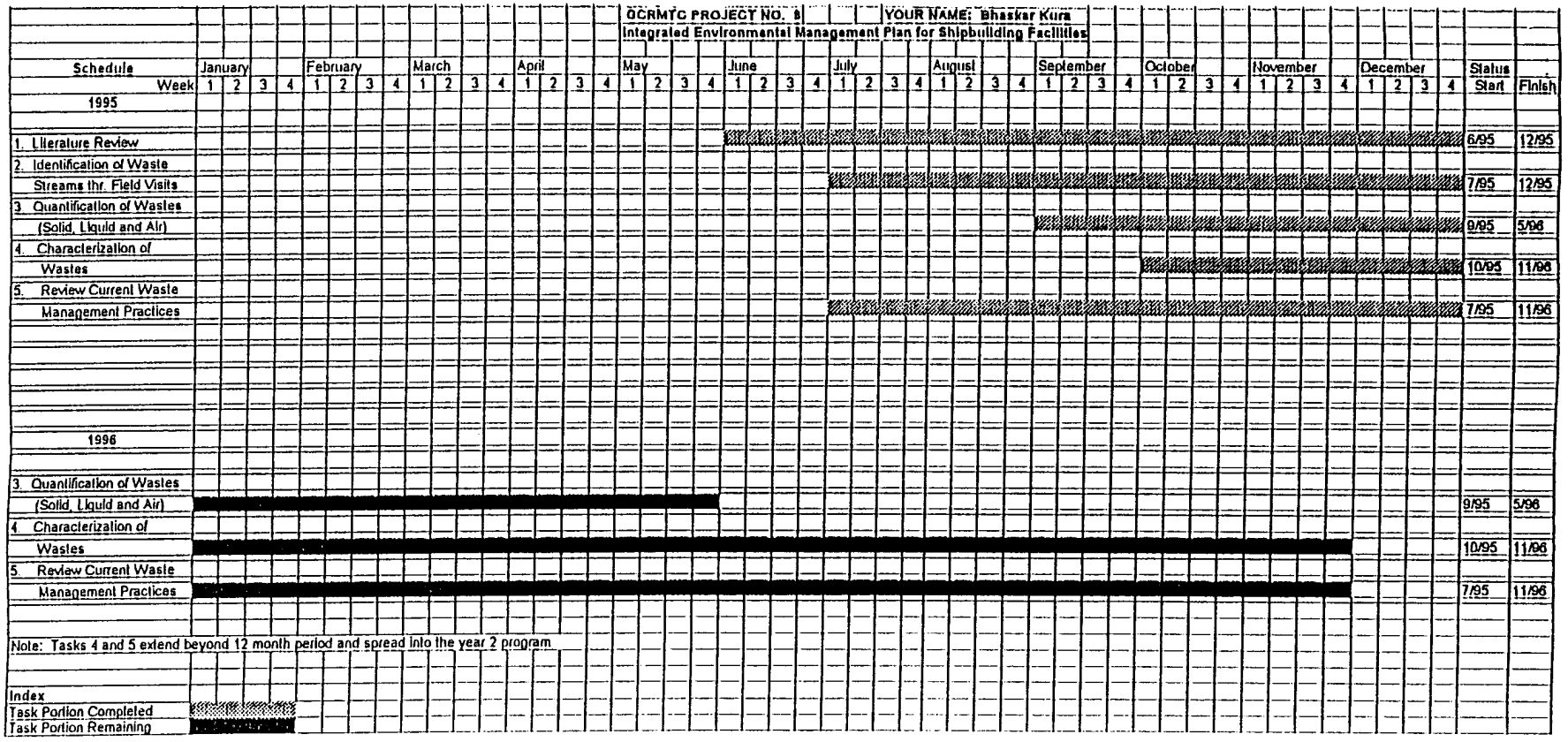


Figure 1. Shipyard processes and waste emissions.


GCRMTC PROJECT NO. 8
YOUR NAME: Bhaskar Kura
Integrated Environmental Management Plan for Shipbuilding Facilities
Schedule
Week
January
February
March
April
May
June
July
August
September
October
November
December
Status
Start
Finish
1995
1. Literature Review 6/95 12/95
2. Identification of Waste Streams thr. Field Visits 7/95 12/95
3. Quantification of Wastes (Solid, Liquid and Air) 9/95 5/96
4. Characterization of Wastes 10/95 11/96
5. Review Current Waste Management Practices 7/95 11/96
1996
3. Quantification of Wastes (Solid, Liquid and Air) 9/95 5/96
4. Characterization of Wastes 10/95 11/96
5. Review Current Waste Management Practices 7/95 11/96
Note: Tasks 4 and 5 extend beyond 12 month period and spread into the year 2 program
Index
Task Portion Completed
Task Portion Remaining

APPENDIX D

DEVELOPMENT OF HIGH SPEED MARINE VEHICLE DESIGN DATABASE

GCRMTC PROJECT NO. 95-010A

Principal Investigator: **Robert Latorre**
Naval Architecture and Marine Engineering

Additional Researchers: **Paul Herrington**
Department of Mechanical Engineering

Michael Folse
Department of Civil and Environmental Engineering

Marcio Vasconcellos
Naval Architecture and Marine Engineering

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: This project addresses the lack of necessary data for selecting an efficient and economically priced high speed marine craft. The project emphasizes the development of required design standards and database methodology for systematic studies focused on the design of high speed marine transport craft. Presently these craft are being developed in Northern Europe and the Pacific Rim countries. With the weakening of the US dollar, there is a developing market niche for US shipyards to competitively market these craft worldwide. The project also includes design and procurement of unique ship structures testing equipment required to test designs based on advanced lightweight materials.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$535,229
FUNDS REMAINING:	$ 1,000

ACCOMPLISHMENTS YEAR TO DATE:

Task I – Survey of state of the art:

Accomplishments October-December 1995

1. Presentation of technical paper at November 24, 1995 London meeting of the Royal Institute of Naval Architects.
2. Presentation of technical paper at the December 8, 1995 SNAME Biloxi, MS meeting.

Prior Accomplishments

1. Completion of high speed marine vehicle data base program organization.
2. Entries of 450 recreational (22-75 ft.) and 100 commercial catamaran vessels into data base.
3. One technical paper presented at the 3/30/95 SNAME meeting.
4. Literature review completed covering ten journals (1980-1994). Approximately 50 entries were obtained for the data base.
5. Developed recreational power boat performance database for approximately 400 boats (length 20 – 50 ft) including monohulls as well as catamarans.
6. Attended NSWC David Taylor Model Basin symposium (High Performance Ships in East Asia and Australia by Dr. Frank Peterson, 1/10/95).

Task II – Domestic/Overseas shipyard visits:

Accomplishments October-December 1995

1. Completed, travel reports submitted.

Prior Accomplishments

1. Domestic shipyard meetings with Swiftships (Morgan City, LA).
2. Domestic shipyard technical meeting with Trinity Marine (2/95, Gulfport, MS).
3. Domestic shipyard technical meeting with Bath Iron Works (6/95, Bath, Maine).
4. Overseas visit to Australian shipyards (4/95).
5. Visited NSWC David Taylor Research Center Ship Structures laboratory (1/95).
6. Visited Lehigh University ATLSS laboratory (5/95).

Task III a). – Catamaran design rules:

Accomplishments October-December 1995

1. ABS draft rules in review.

Prior Accomplishments

1. Dr. Latorre appointed to ABS Draft Rule Task Group for Catamaran/Multi-hull/SES/Hydrofoil Ship Structures. Rule guide scheduled for January 1996.
2. Obtained ABS rules for high speed craft.
3. Obtained DNV rules for catamarans.
4. Obtained BV, GL, and RIN rules for high speed craft.
5. Obtained Solas rules for passenger craft.
6. Developed CATLOADI software program for calculation of loads on catamaran hull for structural design.
7. Developed design rules for estimating the low resistance geometry of catamaran hulls to be validated by tow tank tests.

Task III b). – Proposal development:

Accomplishments October-December 1995

1. Task was completed in February 1995.

Prior Accomplishments

1. Completed, awaiting MARITECH response.
2. Proposal with Swiftships submitted to ARPA/MARITECH program 2/14/95.

Task IV – Development of CIM strategy for proposed ship:
Accomplishments October-December 1995

1. CIM plan of aluminum test panel with/without floating frames.

Prior Accomplishments
1. Coordinate with Swiftships (Shipyard 21 Project) on development of computer integrated manufacture of catamaran hull structure.
2. Bid specification for test equipment completed.

Task V a). – Tow tank testing:
Accomplishments October-December 1995

1. Model A design completed.

Prior Accomplishments
1. Manufactured and tested models C1 and C2 used to evaluate design rules regarding catamaran separation distance and hull inclinations.

Task V b). – Preliminary structures testing:
Accomplishments October-December 1995

1. Assembled structural test frame in structures laboratory.
2. Analyzed two stiffened plate structures using finite element method.

Prior Accomplishments
1. Contract awarded to Scientific Marine Services of Escondido CA, for the structural test system.
2. Donation of large load/stroke hydraulic system from Swiftships for destructive testing of hull sections.
3. Preliminary design of catamaran structural sections I and II begun with Swiftships.
4. Purchased computer and finite element analysis software for analysis of structure to be tested.
5. Visited NSWC David Taylor Research Center Ship Structures laboratory.
6. Visited Lehigh University ATLSS laboratory.

Task VI – Workshop and final report:
Accomplishments October-December 1995

1. Presentation of the technical paper entitled, "Development of High Speed Marine Vehicle Design Database - Lessons Learned," at SNAME meeting.

Prior Accomplishments
Workshop scheduled as part of SNAME Gulf Section meeting.

PROPOSED ACTIVITIES NEXT PERIOD:

Task I – Market overview using CATSSD data base (from task II, Year 1) and shipyard input to define:

1.1 Size of catamaran (Months 1-3)
1.2 Speed of catamaran (Months 1-3)
1.3 Operating services to match market niche (Months 1-3)
1.4 Design/Production requirements (Shipyard*)
1.5 Preliminary build strategy - modules, erection sequence (Shipyard*)

Task II – Structural test system

1. Completed installation of test system.
2. Test of aluminum ship structure in test frame.

COLLABORATIVE EFFORTS:	**This Qtr.**	**YTD**
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:	–	$80,000
ACTUAL FUNDS:		
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:	–	–
ACTUAL FUNDS:		
# OF SIGNIFICANT CONTACTS:		
INDUSTRY:	3	14
ACADEMIC:	–	3
GOVERNMENT:	–	4

COMMENTS:

$ VALUES OF SERVICES FROM INDUSTRY:

Swiftships, Inc., has agreed to materially participate in this project by contributing the following:

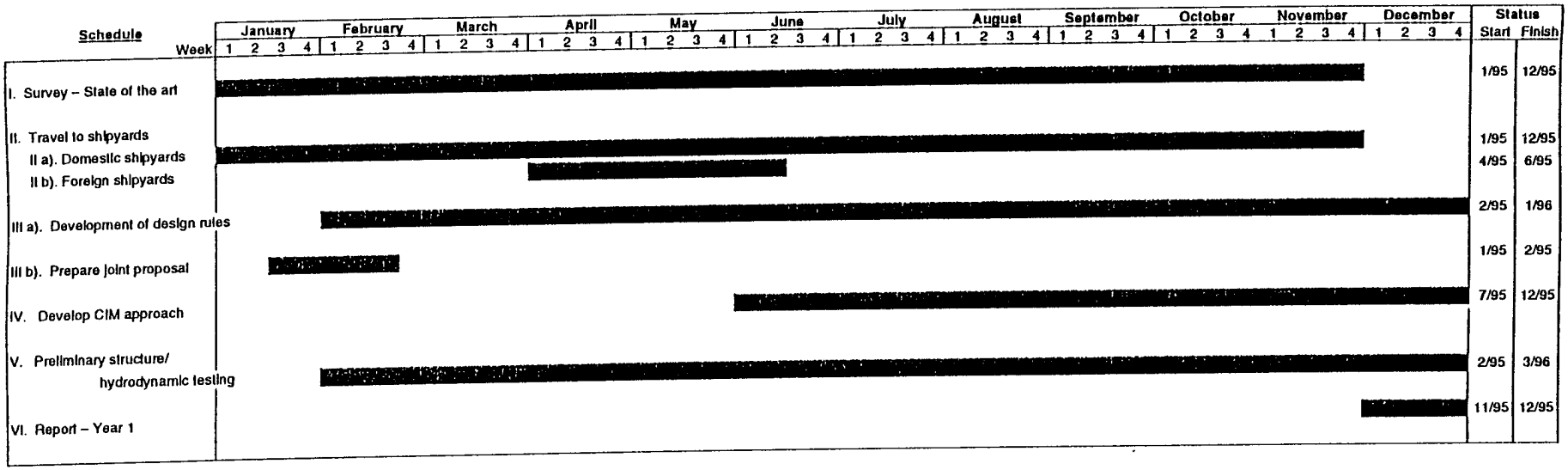
1. Participate in the catamaran structure design/analysis. (Estimated value = $5,000)
2. Deliver two structural prototypes to be tested in the ship structures test system. (Estimated value = $50,000)
3. Contribute hydraulic pump and actuators for high force testing. (Estimated value = $25,000)

This participation represents an in-kind match of materials and technical labor valued in the range of $75,000 to $90,000.

NUMBER OF SIGNIFICANT CONTACTS:

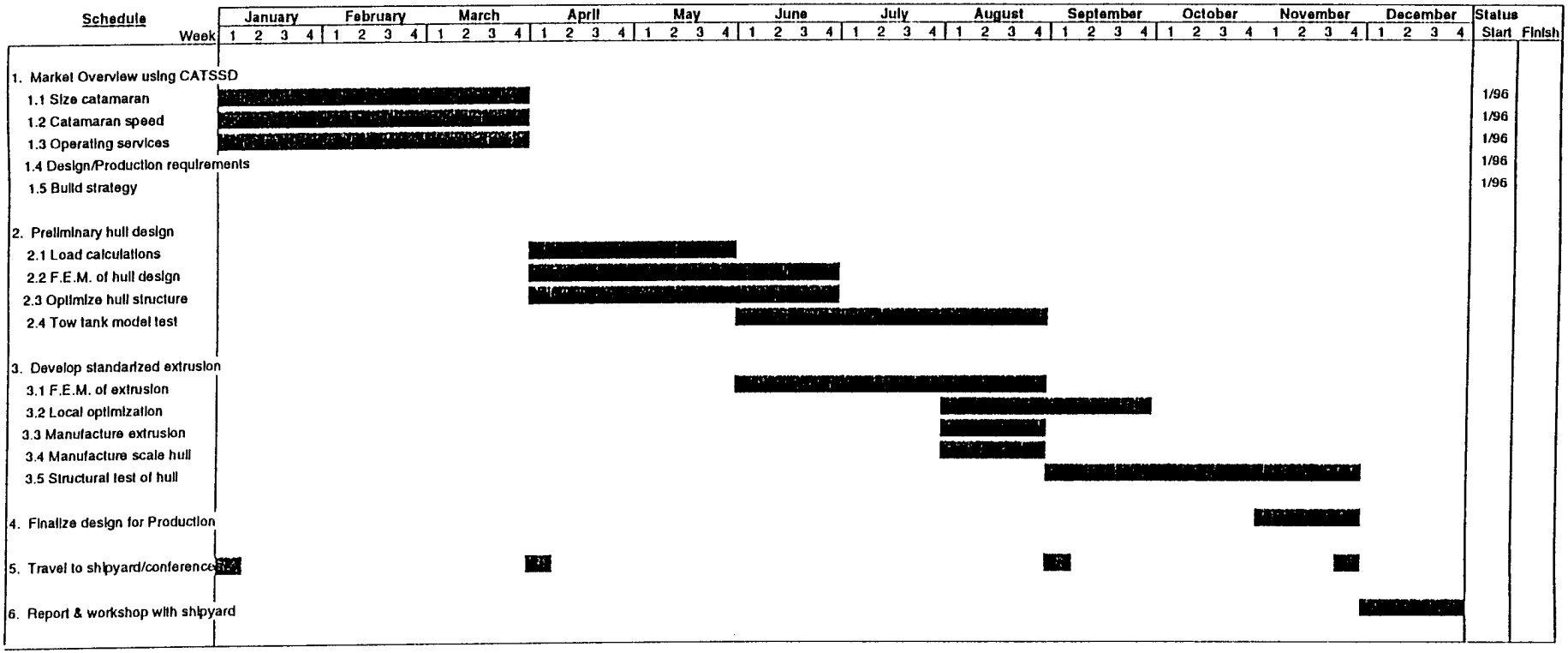
Industry contacts made include ABS, Swiftships, Trinity Marine, Ingals, Gladden & Hearn, and Bath Iron Works. Academic contacts were established with Lehigh University, while government contacts include personnel at the David Taylor Research Center.

Development of High Speed Marine Vehicle Design Database



UNO-Swiftships Development of A Cost Effective Aluminum Catamaran Structure Incorporating Extrusions

A continuation of Project #10 Development of High Speed Marine Vehicle Design Database



APPENDIX E

APPLICATIONS OF INTEGRATED OPTICAL FIBER SENSOR SYSTEMS IN SHIPBUILDING AND SHIPBOARD MONITORING

GCRMTC PROJECT NO. ATMC95-014A

Principal Investigator: **Shing Lee**

Department of Electrical Engineering

University of New Orleans

New Orleans, LA 70148

PROJECT SYNOPSIS: We propose a novel fiber-optic-sensor system based on in-line photopolarimetric measurements using D-shape fibers to address the performance and cost issues. The system is compact, sensitive, and can be multiplexed throughout the ship to provide hazard warning, pollution monitoring, processing monitoring, etc. With the use of the D-shape fiber, the sensor head is integrated to improve the compactness and reliability. This work is to investigate the applicability of shipboard monitoring using such a fiber optic system.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$192,039
FUNDS REMAINING:	$ 89

ACCOMPLISHMENTS YEAR TO DATE:

TASK I - Survey of current sensor technology

Accomplishments Oct. - Dec., 1995
- This task was completed in Nov. 1994.

Prior Accomplishments:
- Survey of literature detailing industrial needs and current state of sensor technology.
- Visited Ingalls shipyard and discussed with the shipbuilding representatives on the needs for sensors in the shipbuilding industry as a whole. Collaboration agreement between UNO and Ingalls shipyard had already been established.

TASK II - Sensor design

Accomplishments Oct. - Dec., 1995
- Redesign our new in-line photopolarimeter into a more compact, rugged and economical one.
- Design the next generations of large sensor network using fiber gratings. A new design of large scale integrated sensor network has been designed with the use a combination of spatial and wavelength division techniques.

Prior Accomplishments:

- From the survey of literature, we decided to develop fiber sensors using dual use technology to reduce development cost and speed up the process. Seventy percent of the sensors in most industries including shipbuilders are temperature and pressure sensors. Furthermore, polarimetric sensors are the only ones that simultaneously detect temperature and pressure. We chose this approach because we had extensive experience with the development of photopolarimeters.
- Theoretical analyses of waveguide modes and directional couplers were completed using a newly developed method, i.e., finite-difference vectorial-beam-propagation method using Yee's discretization scheme. The results were presented in the Optical Society of America annual meeting in Sept. 1995, Laser and Electro-Optic Society annual meeting 1996, and submitted for publications in IEEE and OSA journals.
- Evanescent absorption, phase modulation, and directional coupling sensors have been studied theoretically.

TASK III - Acquiring equipment and setting up laboratory for building fiber sensors

Accomplishments Oct. - Dec., 1995

- We have purchased equipment and components to build a more compact in-line photopolarimeter and are preparing for field tests in Ingalls.

Prior Accomplishments:

- The HP polarization analyzer which is the most critical equipment arrival in June 1995. Setting up the laboratory to build and test the prototype sensors in Phase I was completed in early July, 1995.

TASK IV - Prototype fabrication and testing

Accomplishments Oct. - Dec., 1995

- The viabilities of two finalized photopolarimeters were investigated. One design uses a 1X5 commercial fiber directional coupler while the other approach uses two liquid crystal retarders and an analyzer. Although the first approach was more suitable for our application, it was also an untested technology. Therefore, we built the second type as a backup. Both prototypes have been successfully demonstrated. The results will be submitted to IEEE Photonic Technology Letters pending approval.
- Bending induced linear birefringence was studied. This effect will be used to construct a non-intrusive and more compact in-line photopolarimeters and controller. A simple fiber loop will replace the only bulk optic component in our system, i.e., the quarter wave retarder.
- Controlled etching on D-shape fiber was an essential part of the our polarimetric sensor development. The various distances between the flat surface to the fiber

cores were obtained using HF etching. The etching process was simple but monitoring the distances was very important in sensor applications. We devised a way to monitor the etching process by monitoring ellipticity of polarized light using the HP spectrum analyzer and the polarization controller.

Prior Accomplishments:

- The effects of fiber twisting on the state of polarization was under thorough investigation. We found an accurate mathematical model to describe the twisting effects.
- Evanescent absorption sensors using D-shape fibers are under investigation. The effects of the core to flat surface on evanescent coupling in the D-shape fibers were studied theoretically.
- Polarization-preserving fiber-optic directional couplers have many potential applications in fiber optic sensors such as temperature and pressure sensors. Such directional couplers were under investigation; and the results were presented in the LEQS meeting at the end of October, 1995.
- Fiber optic temperature and pressure sensors using polarization-dependent directional couplers were very attractive because of their high sensitivities and wide dynamic ranges. We had previously tried a few low cost approaches including the use of silicon V-grooves and capillary glass tubes. The results, however, were less than satisfactory. Due to a recent collaboration with the Optical Fiber Technology Center in Australia, we have obtained some dual-elliptical-core fiber which is an intrinsic polarization-dependent directional coupler.

TASK V - Field Integration, test and industrial collaboration

Accomplishments Oct. - Dec., 1995

- We established collaboration with the Optical Fiber Technology Center in Australia. They had been interested in developing and marketing specialty fibers such as dual core fibers. They supplied us with custom made dual core fibers for our strain and temperature sensors in a collaboration effort.
- Based on our work on this fiber optic sensor and the flashover projects, Entergy is very likely to become our next industrial partner for developing pollution-monitoring fiber optic sensors. A formal proposal has been submitted to Entergy for a $60,000 collaboration effort, and it is in its final approval stage.
- The two fiber optic sensor projects have been streamlined for field testing in Ingalls' shipyard. We agreed on using a common computer interface and packaging for our sensor systems.

Prior Accomplishments:

- We contacted a number of fiber optics manufactures such as 3M, Oz Optics, Wave Optics, 3M and United Technologies for joined developing shipborne fiber optic sensors. United Technologies and 3M were particularly interested in our fiber grating network.

- A collaboration agreement between UNO and Ingalls shipyard has already been established. Our sensors will be tested on board ships early next year.

PROPOSED ACTIVITIES NEXT PERIOD:

1. The main purpose of this project is to develop a high capacity fiber optic sensor system for shipborne sensing. A novel tunable fiber-optic Er-doped laser will be built to interrogate the fiber-grating sensor network. Novel techniques of fabricating fiber grating using a phase mask and excimer laser will be tested.
2. Further improving the newly developed in-line photopolarimeter and sensor heads.
3. Continue to work on the interface and package of the sensor systems for field testing.

COLLABORATIVE EFFORTS:

$ VALUES OF SERVICES FROM INDUSTRY:

INKIND SERVICES:

Dual-elliptical core fiber	$1,500
Cray-90 time from Cray Research 150 hrs @ $400 per hr	$60,000

ACTUAL FUNDS:

None

$VALUES OF SERVICES FROM GOVERNMENT:

IN KIND SERVICES:

None

ACTUAL FUNDS:

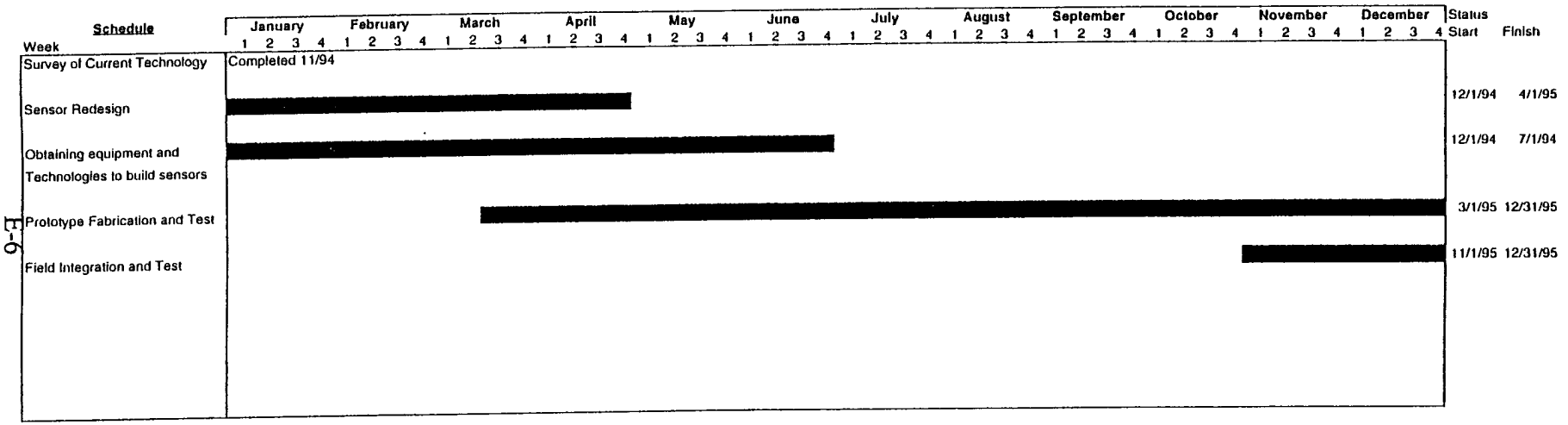
None

 # OF SIGNIFICANT CONTACTS:

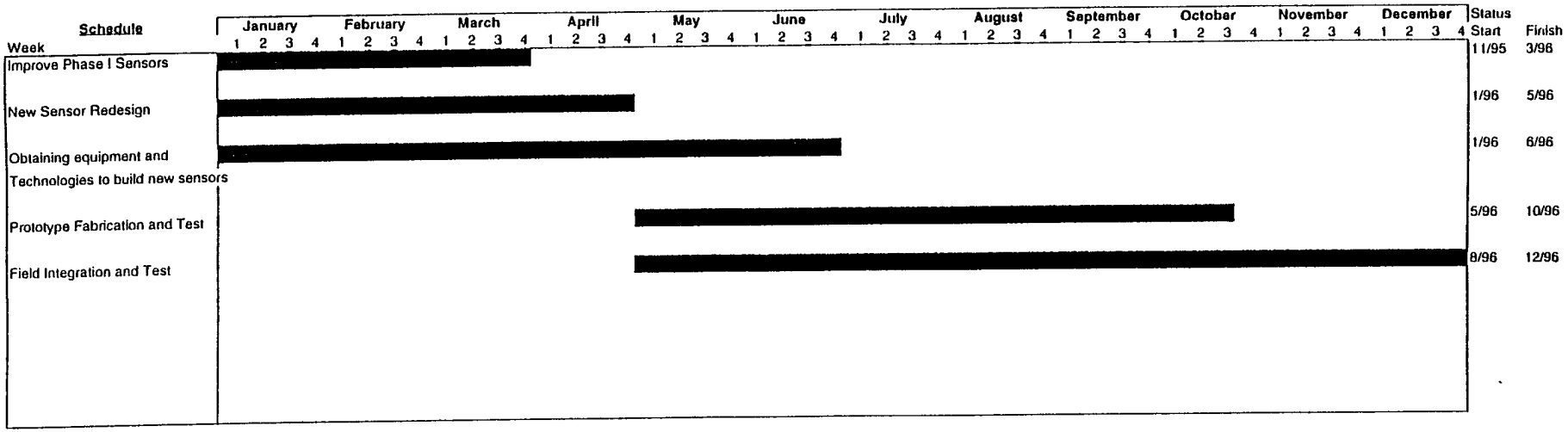
INDUSTRY:

Bob Murray (Ingall Shipyard), James Murphy (United Technologies), Graham Atkin (The Optical Fiber Technology Center, Sydney, Australia), and Braxton Jenkins (Entergy)

Project #14 APPLICATIONS OF INTEGRATED OPTICAL FIBER SENSOR SYSTEMS IN SHIPBUILDING AND SHIPBOARD MONITORING



Applications of Integrated Optical Fiber Sensor Systems in Shipbuilding and Shipboard Monitoring (Phase II)



APPENDIX F

SHIPBOARD SENSORS

GCRMTC PROJECT NO. AMTC95-016A

Principal Investigator: **Russell E. Trahan, Jr.**
Department of Electrical Engineering

Co-Principal Investigator: **Paul Chirlian**
Department of Electrical Engineering

University of New Orleans

New Orleans, LA 70148

Project No. 16

PROJECT SYNOPSIS: The main thrust of the first phase of this project is *Task 1: survey of current technology.* This survey consists of a reexamination of the present US Navy requirements for sensors aboard ships and also a survey of commercial vessel requirements. This task is completed. *Task 2: Sensor redesign* is nearly completed. *Task 3: Design of data acquisition system* is nearly completed. Parts are on order for construction of the system.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$256,281
FUNDS REMAINING:	$ 7,148

ACCOMPLISHMENTS YEAR TO DATE :

Task 1 - Survey of Current Technology

Accomplishments Oct-Dec 1995:

- This task was previously completed in July 1995.

Prior Accomplishments:

- Performed an extensive study and collection of damage control and other sensor type data and distribution statistics for US Navy combatant classes CG-47, DDG-51, and LHD-1.
- Analyzed existing fiber optic sensor designs historically developed by the US Navy and reviewed the technology with respect to preservation and cost reductions.
- Acquired and then conducted detailed reviews of Federal regulations and maritime requirements for sensors utilized aboard commercial ships.
- Conducted reviews and held discussions with several shipbuilders and vendors who specify, provide and/or install sensor systems aboard vessels.
- Reviewed other pertinent GCRMTC projects whose outcomes and generated information could be useful on this particular project.

Task 2 - Sensor Redesign

Accomplishments Oct-Dec 1995:

- Completed the analytical optical design of a fiber optic temperature sensor measuring both absolute and rate of temperature change.

- Completed the mechanical design of a temperature sensor prototype.

- Contracted with a vendor to fabricate and deliver a testable temperature sensor prototype.

- Received and installed an environmental chamber for sensor testing.

- Completed laboratory smoke scattering measurements and developed a second candidate approach to a smoke detection technique.

Prior Accomplishments:

- A fiber optic liquid level sensor to detect flooding in compartments and presence of liquids in bilges has been fabricated and tested.

- Smoke chamber using UL268/217 guidelines for the testing of smoke sensors was built.

- Smoke sensor based on a modified design of a commercially available photoelectric sensor which is powered optically via an optical fiber has been completed and tested.

- Selected and assembled a high-powered laser driver for smoke and liquid level sensor power distribution.

- Assembled and evaluated optical-to-electrical power converters and techniques for smoke detector operation.

- Developed a second alternative to the optically-powered smoke device using inherent optical fiber arrays and a scattering function based on scattering angle phenomenon.

Task 3 - Design of Data Acquisition System

Accomplishments Oct-Dec 1995:

- Completed temperature sensor algorithm for processing sensor data.

- Completed circuit design, modeling and construction of hardware for temperature sensor operation.

- Developed system display software for indication of individual sensor and system status.

Prior Accomplishments:

- Developed and constructed unique transmitter and receiver circuits for the liquid level sensor.

- Completed A/D-D/A board interface to a PC.

- Completed sensor algorithms for monitoring the status of the liquid level and smoke detectors.

Task 4 - Prototype Fabrication and Test

Accomplishments Oct-Dec 1995:

- Packaging and interconnection of all optical and electronic components into a demonstrable enclosure is complete.

Prior Accomplishments:

- Completion of optical fiber terminations for interconnection between enclosure and respective sensor.

PROPOSED ACTIVITIES NEXT PERIOD :

For the period January-March 1996 the following activities are expected:

- Receive the temperature sensor prototype from the selected fabricator.

- Complete the testing and characterization of the fiber optic temperature sensor.

- Complete the full system integration of the laboratory prototype including the temperature sensor.

- Begin discussions with Ingalls Shipbuilding concerning the requirements for shipboard installation and evaluation of prototype system.

- Assess the impact of the shipboard system requirements on the laboratory demonstrable system.

- Determine the impact of interfacing and supporting single mode sensors being developed by other GCRMTC investigators on this system's electronics and display capabilities.

- Purchase sensors which are currently used on commercial and US Navy ships for comparison testing and evaluation.

COLLABORATIVE EFFORTS:	**THIS QTR**	**YTD**
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:	0	≈$5000
ACTUAL FUNDS:	0	0
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:	0	0
ACTUAL FUNDS:	0	0

OF SIGNIFICANT CONTACTS:

INDUSTRY: Bill Duke, Litton Data Systems
Ray Johnston/Stan Owen, Ingalls Shipbuilding
John Cognovich, EMI

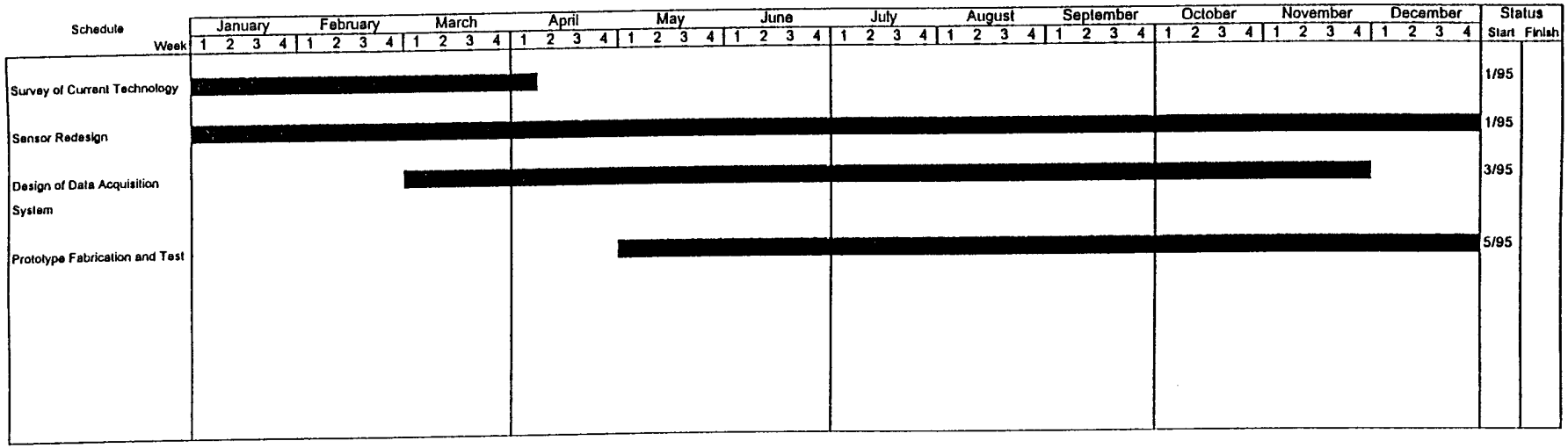
ACADEMIC: Dr. Shing Lee, Department of Electrical Engineering, UNO

GOVERNMENT: Carl Jacobsen, NAVSEA

COMMENTS (to amplify, explain, or add to the above)

The In-Kind services were provided by Ingalls Shipbuilding. Ray Johnston provided us with a complete sensor survey for US Navy ships. This survey was to be done as part of this project. Our best estimate is that the survey cost was at least $5,000.

Shipboard Sensors



Updated Jan. 16, 1995

RESEARCH WORK SCHEDULE

Project: Shipboard Sensors (Continuation)

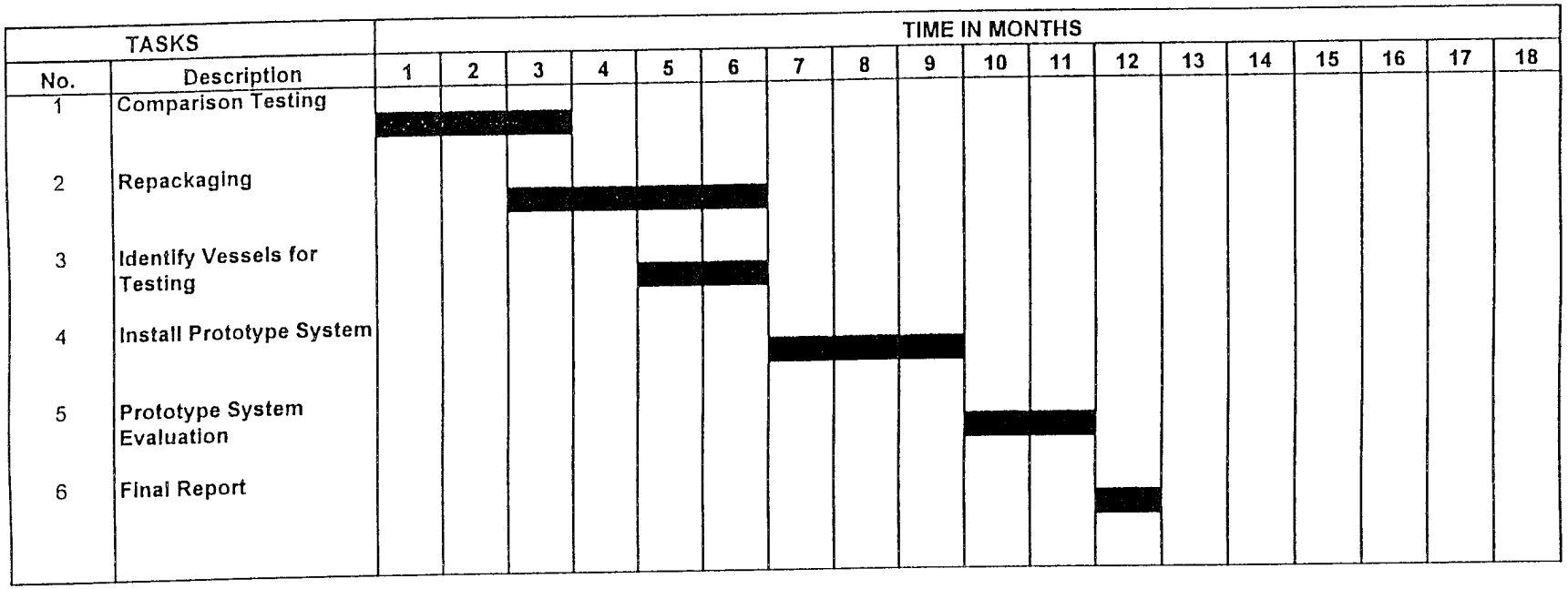


Figure 2-6

APPENDIX G

SHIPS' RELIABILITY, AVAILABILITY, AND MAINTAINABILITY (RAM) DATABASE

GCRMTC PROJECT NO. AMTC95-018A

Principal Investigator: **Bahadir Inozu**
School of Naval Architecture and Marine Engineering

Additional Researchers:
Philippe Roy
School of Naval Architecture and Marine Engineering

Bulent Yener
Computer Science Department, Columbia / Lehigh Univ.

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: To establish an integrated RAM database to compile, process, analyze and disseminate field data from merchant ships for new failures, to download existing ship machinery failure history data from ship logs, to access international RAM databases, to investigate reliability and maintainability of existing shipboard components, and to provide a basis for optimizing maintenance and ship building practices, increasing the reliability, safety and quality of U.S. ship operations and recommending new ship designs.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$198,584
FUNDS REMAINING:	$ 21,860

ACCOMPLISHMENTS YEAR TO DATE

TASK I - DATE & SHIPPER Development / Test and Modifications

Accomplishments Oct-Dec 95

The following DATE and SHIPPER modifications were implemented and Version 2.0 has been developed.

1. Extensions to voyage information to cover voyage legs, anchor events, and dry-dock/lay-by events,
2. Removal of repair action dependence upon voyages (repairs can extend across multiple voyages),
3. Ability to modify equipment operation rates under steaming, anchor, port, shipyard/lay-by conditions without losing previous rates,
4. Equipment nameplate data expansion,
5. Addition of flexible equipment class categories,
6. Addition of initial operating hours for equipment,
7. Temporary corrective repairs will be tracked as a folder until such time as the repair becomes permanent,
8. Ability to enter all parts and costs used in the repair,
9. Tabular vessel time line display from any starting point to any ending point,
10. Ability for the chief engineer to override cumulative operating hours and use this value for future computations. Special treatment of equipment under temporary repair.
11. Folder type displays
12. Color coded graphical time line display
13. Header & option & sequence changes
14. Updating help function

15. Standard Windows interface for MDI

New DATE and SHIPPER programs have been tested and data base population started by entering data from log books and machinery failure history records at the headquarters of shipping companies and on board selected ships. The GCRMTC and ARCO's Chief Engineer entered complete RAM history of target equipment for the last two years during the week of December 12, 1995 for the pilot ship ARCO JUNEAU. ARCO also extracted RAM data for a specific pump for the 1987-1995 time period for detailed analysis. Aproval was requested for Part II of DATE and SHIPPER mofications.

Programs were also tested on board Sea-Land EXPEDITION on December 17, 1995. The Center also tested the programs and entered RAM history for selected equipment on board Sea-Land QUALITY for the 1991-1995 period on December 26-January 3, 1996. Arrangements were made for the GCRMTC to test the programs and enter RAM data on board Sea-Land INTEGRITY on January 10-15, 1996.

ETC compiled RAM data from their entire fleet for the 1985-1995 for a specific pump type manufactured by two different companies. The data was entered using the SOCP's DATE program and forwarded to the RAM database via SHIPNET. A detailed data analysis was conducted for these pumps. Failure time probability density functions have been developed using censored data analysis methods. Reliability and failure rate functions have been derived for the pumps of both manufacturers using parametric distributions (such as Weibull) as well as non-parametric ones. Estimations of Mean Time to Failure (MTTF) and reliability functions have been developed both at the equipment and system level since two of these pumps are installed on each vessel with one pump operating and one in standby during normal vessel operating conditions. After the development of failure characteristics, a cost-benefit analysis study has been conducted to examine various overhaul, upgrade and replacement options. Manufacturers of both pumps have been contacted. Both manufacturers provided their own failure information for the study.

Prior Accomplishments

First Versions (Version 1.0) of the Data Entry Program DATE and Ship Performance Review Program were developed and tested at GCRMTC, ETC, Sea-land, ARCO Marine and PRC for three months. Based on the evaluations, various modification/upgrade needs have been identified.

The first version of DATE and SHIPPER was installed on board a US flagged ship of an SOCP member company for end user testing on July 15, 1995.

TASK III- Nameplate Data Transfer

Accomplishments Oct-Dec 95

Name plate data transfer has been continued for selected fields of target equipment. Refinement of critical equipment list by ABS is still underway.

Prior Accomplishments

Name plate data transfer to DATE has been started for ETC, ARCO and Sea-Land ships.

TASK IV - Cross ID Referencing

Accomplishments Oct-Dec 95

Cross ID referencing continued. ABS extracted ship specific critical equipment lists for ARCO and Sea-Land following the discussions at the SOCP executive committee meeting on November 14-15, 1995. Correspondence with STEP AP 226 group continued.

Prior Accomplishments

The first phase of cross referencing with company specific identifiers, preliminary SOCP identifiers and STEP AP 226 identifiers has been conducted for the name plate data of ETC, Sea-Land and ARCO's equipment in addition to the preliminary critical equipment list of ABS.

TASK V - SPIN and SHIPS' RAM Development

Accomplishments Oct-Dec 95

Common modules of SPIN and SHIPS' RAM programs have been designed by DCC based on the double key requirements. Requirements for confidential data censoring to prepare data for master database feed are subject to further refinement after testing. Approval was requested from the GCRMTC's executive director for code development of SPIN and SHIPS' RAM programs.

Prior Accomplishments

Based on the changes in the DATE & SHIPPER modifications, SPIN and SHIPS' RAM specifications have been revised. A general preliminary framework of the Ships' RAM program for current participants was also developed.

TASK IX - DATE Interface

Accomplishments Oct-Dec 95

DATE and AMOS - D interface requirements have been determined for Sea-Land. Determination of DATE interface for ARCO software is underway. USCG's MSTEP interface plan is revised.

Prior Accomplishments

Identification of the interface requirements in order to avoid duplication of data entry has been initiated.

PROPOSED ACTIVITIES NEXT PERIOD:

1. Full scale testing of DATE & SHIPPER version 2.0
2. Code development and testing of SPIN and Ships' RAM software
3. SEM training
4. Strategic planning
5. Build one requirements definition for implementation modules
6. Development of interfaces with ARCO and SEA-LAND software
7. Development of interfaces with regulatory agencies (USCG's MSTEP and ABS' Rules 2000)
8. Population of RAM database / Analysis of RAM data / Creation of SHIPNET help desk
9. International ship network development

COLLABORATIVE EFFORTS:	THIS QTR	YTD
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:		
SOCP/ Energy Transportation Corporation	4 man-weeks $17,000.00	8 man-weeks $34,000.00
SOCP/Sea-Land Service Inc.	3 man-weeks $12,000.00	6 man-weeks $27,000.00

SOCP/ARCO Marine Inc.	1 man-week	2 man-week
	$ 4,000.00	$ 8,500.00

ACTUAL FUNDS:

SOCP: $58,000.00* ($50,000 for Dr.Inozu/UNO + $8,000 for PRC)

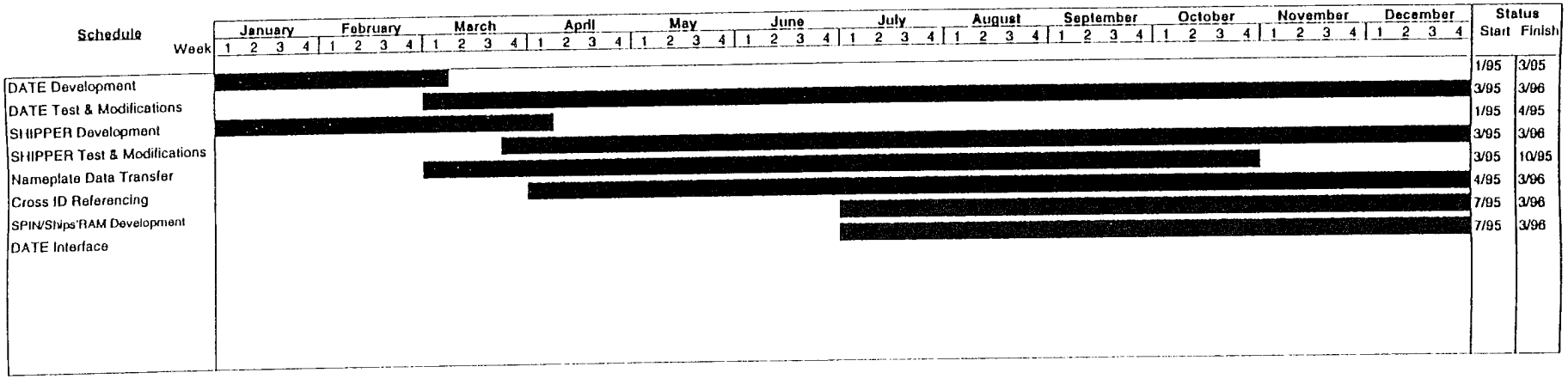
$ VALUES OF SERVICES FROM GOVERNMENT:
IN KIND SERVICES:
ACTUAL FUNDS: Same as above*. SOCP is an industry-government cooperative program.

OF SIGNIFICANT CONTACTS: 11
INDUSTRY: P.G. Schaedel (ETC), M. Bohlman (Sea-Land), F. Lee (ARCO Marine), J. Edgar and R. Nagendran (PRC), R. Conachey (ABS).
ACADEMIC: Prof. Magnus Rasmussen (NTH-Norway), Prof. T. Hashimoto (Kobe-Japan)
GOVERNMENT: J. Dumbleton (MARAD), G. Miante and Z. J. Karaszewski (USCG).

COMMENTS: None.

Ships' Reliability, Availability, Maintainability (RAM) Database

1995



RESEARCH STUDY WORK SCHEDULE

Revised on 12.18.1995

TASKS		TIME IN MONTHS											
No.	Description	1	2	3	4	5	6	7	8	9	10	11	12
1	SEM TRAINING												
2	STRATEGIC PLANNING												
3	BUILD ONE REQUIREMENTS DEFINITIONS												
4	TESTING OF FIRST YEAR DATA COLLECTION & REVIEW SOFTWARE AND SECOND YEAR SPIN / MASTER RAM DATABASE SOFTWARE DEVELOPMENT												
5	DEVELOP INTERFACES WITH REGULATORY AGENCIES												
6	POPULATION OF RAM DATABASE, ANALYSIS OF RAM DATA & CREATION OF SHIPNET HELP DESK												
7	INTERNATIONAL SHIP NETWORK DEVELOPMENT												

APPENDIX H

PERFORMANCE SIMULATION OF MARINE PROPULSION SYSTEMS UNDER EXTREME CONDITIONS

GCRMTC PROJECT NO. AMTC95-020A

Principal Investigator: **Bahadir Inozu**
School of Naval Architecture and Marine Engineering, UNO

Additional Researchers:
Philippe Roy
School of Naval Architecture and Marine Engineering, UNO
Jon Etxegoien and **Jonathan DeHart**
Carderock Division Naval Surface Warfare Center
Jean-Francois Hetet
Ecole Centrale de Nantes, France
Kian Banisoleiman
Lloyd's Register, United Kingdom
Martti Larmi
Helsinki University of Technology, Finland
Bulent Yener
Computer Science Department, Columbia / Lehigh Univ.

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: To examine the steady state and dynamic responses of low and medium speed engines to various extreme loads and failure modes using computer simulation. CDNSWC is primarily interested in the most frequently used types of propulsion systems on commercial cargo vessels.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$192,841
FUNDS REMAINING:	$ 0

ACCOMPLISHMENTS YEAR TO DATE

TASK I- Operation in Ice Brash / Extended Full Load

Accomplishments Oct-Dec 95

CDNSWC provided a third experimental ice load in late October 1995. This load was simulated at UNO using the UNO/ECN Code (SIMBAD) for the Colt-Pielstick 7PC4.2 engine and MERLIN for the MAN B&W 10L42MC engine. The same load was simulated by Dr. Martti Larmi of the Helsinki University of Technology (HUT) for the MAN B&W 10L42MC engine.

Prior Accomplishments

CDNSWC provided the first two experimental loads in August 1995 and September 1995, respectively. They were simulated at UNO for the Colt-Pielstick 7PC4.2 with both SIMBAD and MERLIN and for the MAN B&W 10L42MC with MERLIN. MERLIN was modified by Dr. Banisoleiman to accommodate this special algorithm requiring two look-up tables.

TASK II - MERLIN / Low Speed

Accomplishments Oct-Dec 95

For the third experimental load algorithm for the low speed engine, MERLIN was run at UNO and MERLIN and the HUT Code results have been compared for the MAN B&W 10L42MC engine.

Prior Accomplishments

Dr. Kian Banisoleiman developed a MERLIN model for the MAN B&W 10L42MC engine. MERLIN was modified to expand its capabilities, especially regarding the acceptance of

complicated loads at the request of CDNSWC. Engine response to two experimental loads were simulated and analyzed at UNO.

TASK III - SIMBAD Medium Speed (Modeling)

Accomplishments Oct-Dec 95

SIMBAD 7PC4.2 model was found sufficient for the third experimental load. Hence, the modeling completed in September 1995 was not modified.

Prior Accomplishments

The model for the Colt-Pielstick 7PC4.2 engine was completed in May 1995. Coltec Industries (Beloit, Wisconsin) and S.E.M.T. Pielstick (France) provided the necessary engine data. SIMBAD was used to simulate the 7PC4.2 response under ramp loads, impulse loads, selected sample ice loads and the three CDNSWC experimental ice loads.

TASK IV - MERLIN / Medium Speed

Accomplishments Oct-Dec 95

Engine responses to the third ice load was simulated and analyzed.

Prior Accomplishments

A MERLIN model was developed for the Colt-Pielstick 7PC4.2 engine at UNO. The model was completed at the end of July 1995 and improved in August 1995.

TASK V - SIMBAD / Ramp Loads

Accomplishments Oct-Dec 95

This task was completed in June 1995.

Prior Accomplishments

The response of the Colt-Pielstick 7PC4.2 engine under selected ramp loads was provided to CDNSWC. The main focus was to develop the power-rpm characteristics in addition to BMEP, injection timing, combustion heat release, in-cylinder air excess and combustion efficiency. The objective was to provide the information necessary to the establishment of the load algorithms at Carderock.

TASK VI - SIMBAD / Impulse Loads

Accomplishments Oct-Dec 95

This task was completed in July 1995.

Prior Accomplishments

A special version of the UNO/ECN code was developed without the governor to avoid interference from the governor model. Engine responses to various impulse loads were obtained with the UNO/ECN code.

TASK VII- SIMBAD / Modifications

Accomplishments Oct-Dec 95

This task was completed in September 1995.

Prior Accomplishments

Various modifications were implemented to accomodate new load algorithms. The entire turbocharger modeling of the UNO/ECN Code was also enhanced, leading to a new version.

TASK VIII- MERLIN / SIMBAD Comparison

Accomplishments Oct-Dec 95

The comparison between MERLIN and the UNO/ECN Code results was completed. Various numerical problems were detected in MERLIN for certain runs. Limitations of MERLIN code have been attributed to the lack of pipe to compressor connectivity which is currently under development at Lloyd's Register.

Prior Accomplishments

A preliminary comparison was completed on September 1, 1995. MERLIN and SIMBAD (UNO/ECN) results for the Colt-Pielstick 7PC4.2 have been compared for the steady state and transient runs. SIMBAD is equipped with a combustion efficiency model whereas MERLIN does not include such a model. This was found as the major difference between MERLIN and SIMBAD.

TASK IX - HUT Code / Low Speed (Modeling and Runs)

Accomplishments Oct-Dec 95

Dr. Martti Larmi completed several runs as requested. Dr. Larmi's final report was received at UNO in late December. Results of the HUT Code and MERLIN are compared. Simulation results have also been forwarded to the engine manufacturer for final comments.

Prior Accomplishments

Dr. Larmi completed his model in mid September and sent some preliminary results for the first load algorithm on September 28, 1995.

TASK X - HUT Code / MERLIN Comparison

Accomplishments Oct-Dec 95

HUT Code and MERLIN results for engine speed and torque were quite similar. However, HUT Code includes a governor model whereas MERLIN model was developed without the addition of a governor. Governor response of the HUT Code raised some questions regarding the limitations of this code.

Prior Accomplishments

A preliminary comparison was conducted between HUT and MERLIN modeling.

TASK XI- Report and Final Analysis

Accomplishments Oct-Dec 95

A draft of our report has been completed, and copies were sent to MAN B&W (Denmark), Dr. Banisoleiman (England) and Dr. Jean-Francois Hetet (ECN, France) for final comments and improvements. Simulation results and content of the final report were discussed at CDNSWC on December 14, 1995.

Prior Accomplishments

N/A

PROPOSED ACTIVITY NEXT PERIOD:

Project completed. The final report will be released when concluding comments from engine manufacturers, Dr. Hetet, Dr.Banisoleiman and Dr. Larmi are received.

$ VALUES OF SERVICES FROM INDUSTRY: THIS QTR YTD

IN KIND SERVICES: Colt Industries, Milwaukee, WI*
MAN B&W, Copenhagen, Denmark*
S.E.M.T. Pielstick, Paris, France*

ACTUAL FUNDS: -

$ VALUES OF SERVICES FROM GOVERNMENT:

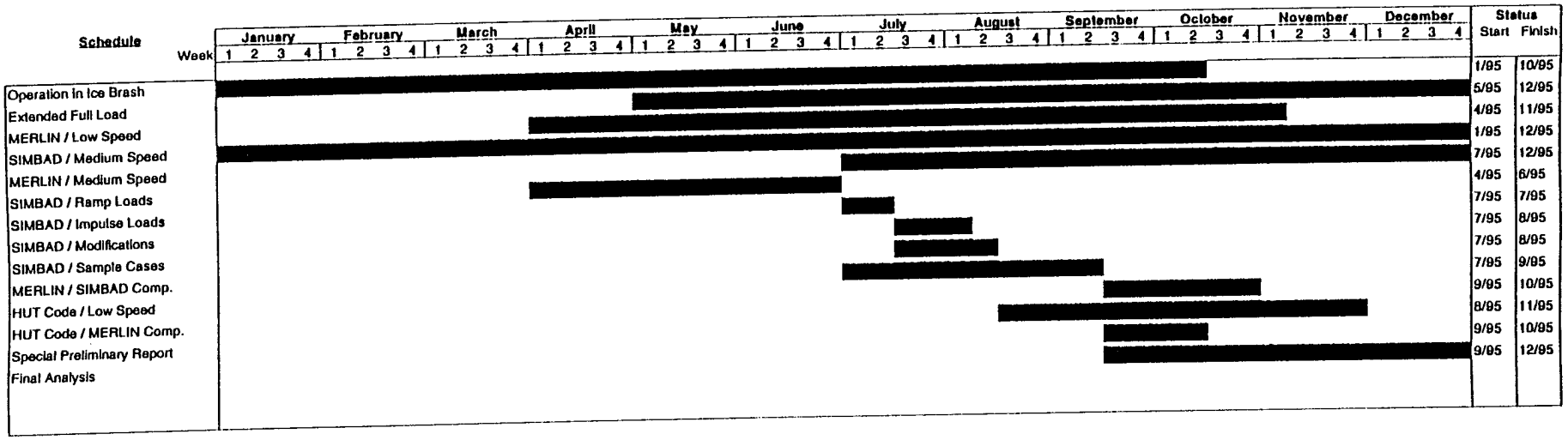
IN KIND SERVICES:	CDNSWC / Jonathan DeHart	1/2 Man -Year
	CDNSWC / Jon Etxegoien	1/4 Man -Year
	CDNSWC / Phil Jung	1/4 Man - Year
	Total CDNSWC	$113,500.00

ACTUAL FUNDS:

OF SIGNIFICANT CONTACTS: 10
INDUSTRY: Angelo Mazzenga and Greg Gutoski, Colt Industries, Peter Sunn Pedersen and Eric Rosenlund, MAN B&W (Denmark), S.E.M.T. Pielstick (Via Dr. Hetet, France), Kian Banisoleiman, Lloyd's Register (UK).
ACADEMIC: J.F. Hetet (ECN), M. Larmi (HUT), B. Yener (Columbia/Lehigh)
GOVERNMENT: J. DeHart and J. Etxegoien, Carderock Division Naval Surface Warfare Center

COMMENTS:
*Engine manufacturers Colt, MAN B&W and S.E.M.T. Pielstick have been providing confidential engine and test bed data for validation and examining simulation results continuously.

Performance Simulation of Marine Propulsion Systems under Extreme Conditions



Revised on 12.18.1995

RESEARCH STUDY WORK SCHEDULE

No.	TASKS Description	TIME IN MONTHS 1	2	3	4	5	6	7	8	9	10	11	12
1	SEM TRAINING												
2	STRATEGIC PLANNING												
3	BUILD ONE REQUIREMENTS DEFINITIONS												
4	TESTING OF FIRST YEAR DATA COLLECTION & REVIEW SOFTWARE AND SECOND YEAR SPIN / MASTER RAM DATABASE SOFTWARE DEVELOPMENT												
5	DEVELOP INTERFACES WITH REGULATORY AGENCIES												
6	POPULATION OF RAM DATABASE, ANALYSIS OF RAM DATA & CREATION OF SHIPNET HELP DESK												
7	INTERNATIONAL SHIP NETWORK DEVELOPMENT												

APPENDIX I

STUDY OF STRUCTURAL DESIGN PROCEDURES IN THE SHIPBUILDING INDUSTRY

GCRMTC PROJECT NO. AMTC95-023A

Principal Investigator: **Michael Folse**
Department of Civil and Environmental Engineering

Additional Researcher: **Norma Jean Mattei**
Department of Civil and Environmental Engineering

Additional Researcher: **José Marcio Vasconcellos**
Department of Naval Architecture and Marine Engineering

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: This project has evolved from the proposed project and is scheduled to be completed at the end of March, 1996.[1] Originally this study involved a survey of the design procedures currently in use in the shipbuilding industry. During the preliminary design procedure survey, the original PI's found that there are three levels of design in the shipbuilding industry. The lowest level of design (and the one used almost exclusively by ship designers) is the "rules". These rules, specific to each certification agency, are empirically based on what has historically yielded a relatively safe product. The highest level of design is a probability of failure-based procedure published by the Ship Structures Committee. This level is not sufficiently developed for practical use in industry for ship design (too many simplifying assumptions), but represents the present state at which researchers are with respect to creating a reliability-based design method. Somewhere between the empirical rules and the subsequent probability-based procedure is a rational design method using quantified loads and load factors in conjunction with a finite element analysis for ship design.

Most of the major certification agencies have either recently published or will soon publish this type of design method. Because rational design signifies a break from traditional methods of design and requires a dedication of significant manhours in order to learn a new procedure, many ship designers are hesitant to change from their old methods of design and learn the new procedure. However, certification agencies are slowly progressing toward making rational design a requirement for many vessels. In 1995, ABS required the use of SAFEHULL, their rational design method, for the certification of tankers.

With the mission of the GCRMTC in mind, the PI's decided that domestic shipbuilders would be best served by focusing the project effort on a comparison of the structural requirements of the ABS Rules versus ABS SAFEHULL Program for several components at midship of a tanker. Furthermore, the bases for each of these two approaches will be evaluated and compared, particularly with respect to their effect on the economics of the ship structure. Additionally we will study the influence of corrosion allowances on long term vessel performance and economics by varying plate thickness in the above-mentioned tanker and calculating the corresponding effect on initial versus lifetime costs.

[1]See the note listed in the "Accomplishments section of this report.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$98,372
FUNDS REMAINING:	$21,586

ACCOMPLISHMENTS THIS PERIOD:

NOTE: *This project was approved to start March of 1995, rather than the usual start date of January. The time line that is attached to this report is indicative of this delay in beginning work. The original scope of work has been revised and expanded.*

The original project contained seven tasks that will briefly be outlined below. After completing the first three tasks, the PI's decided that in order to better serve the domestic shipbuilding industry, the project could be modified and the scope of work increased at little additional cost. These revised tasks will be outlined in the rest of this section.

Original tasks: 1. Survey of design procedures in the shipbuilding industry.
2. Literature search of current state of research on design procedures.
3. Evaluation of uncertainties in ship loadings.
4. Effect of a Load Resistance Factor Design on the industry.
5. Determination of impact of new procedure on industry.
6. Demonstration, if justified, of a preliminary LRFD design approach.
7. Final report as end deliverable.

Revised project tasks:

Task 1 Survey of design procedures in the shipbuilding industry.

Accomplishments Oct-Dec95
- This task was completed April 1995.

Prior Accomplishments
- Surveyed ABS and DNV rules for steel ship design.
- Ordered several relevant Milspecs and other specifications.
- Collaborated with McDemott Shipbuilding Inc.'s Kirk Meche. MSI agreed to provide scantling drawings on a combination container-bulk carrier ship.

Task 2 Search and hire a full time graduate assistant.

Accomplishments Oct-Dec95
- This task was completed June 1995.

Prior Accomplishments
- Ram Mohan, a Ph.D. student, was hired as of May 29, 1995. He graduated from Anna University in Madras, India with a Master of Engineering in Structures. Due to visa problems, Mr. Mohan began work in August, 1995.

Task 3 Evaluate ship loadings, uncertainties, and ascertain the current state of research.

Accomplishments Oct-Dec95

- This task was completed August 1995.

Prior Accomplishments

- Identified the American Bureau of Shipping's (ABS's) SAFEHULL system as an intermediate level between rules-based and a probability-based design procedures. In order to better serve the domestic shipbuilding industry, it was decided that this project focus on evaluating some key structural elements at midship of an existing vessel using both ABS Rules and SAFEHULL.
- Acquired and studied SAFEHULL for bulk carriers. Scantling drawings and design calculations of McDermott Shipbuilding Inc.'s (MSI's) vessel were studied, but using that ship as a basis for this comparison was abandoned. The MSI ship is a combination container-bulk carrier; the design of this type of ship has not yet been addressed by SAFEHULL. SAFEHULL System for Bulk Carriers is written for the design of bulk carriers that meet specific geometric and structural parameters.
- Selected a tanker as the vessel type for comparison purposes.
- Acquired the SAFEHULL System for Tankers free of charge from ABS and temporarily installed it on a departmental PC normally dedicated for other purposes.
- Requested and got approval for the purchase of a permanent PC.
- Identified the tanker parameters to be met for applicability with respect to use of SAFEHULL.
- Increased the scope of work through the inclusion of Dr. Marcio Vasconcellos. The effect of corrosion on lifetime costs will now be studied (Task 9).

Task 4 Search and hire grad assistants #2 and #3.

Accomplishments Oct-Dec95

- This task was completed August 1995.

Prior Accomplishments

- Hired two NAME graduate students at 50% time for the duration of the Fall semester, Ms. Rajani Kandarpa and Mr. Sudhakar Tallavajhula. They are familiar with the rules of several certification agencies.

Task 5 Run SAFEHULL test case.

Accomplishments Oct-Dec95

- This task was completed September 1995.

Prior Accomplishments

- Ran test runs of SAFEHULL *"phase a"* . The SAFEHULL software package is divided into two phases, *"phase a"* that generates a preliminary design and *"phase b"* that incorporates the preliminary design into a finite element mesh, runs the finite element analysis, and modifies the design appropriately.

Task 6 Acquire tanker drawings and manual.

Accomplishments Oct-Dec95

- Contacted Friede and Goldman, who in turn suggested that Ingalls Shipyards be contacted.
- Contacted, at the suggestion of the Government Program Manager, Mr. Rick Nelson of Newport News and the Navy's Mr. Jerry Sikora. Mr. Sikora suggested that Avondale be contacted.
- Ingalls was evidently not interested in the project.
- An applicable tanker will be identified and the drawings and loading manual acquired from Mr. Niolet, Avondale Shipyards.

Prior Accomplishments

- Contacted MSI and A. K. Suda in the search for drawings and a loading manual of a tanker which would fit the requirements of SAFEHULL. Since the vessel must be double hull in order to meet recent federal regulations and satisfy SAFEHULL applicability requirements, the pool of available tankers is quite small. The proprietary nature of these documents also constrained the search.

Task 7 Purchase and setup required software on the permanent new computer.

Accomplishments Oct-Dec95

- Purchased a computer system capable of running both phases of SAFEHULL.
- Installed SAFEHULL software and the companion finite element analysis program.
- Ran test cases to ensure proper working of the software.

Prior Accomplishments

- N.A.

Task 8 Comparison of ABS Rules versus ABS SAFEHULL.

Accomplishments Oct-Dec95

- Began comparing acquired tanker requirements to those of ABS Rules.
- Began inputting acquired tanker into SAFEHULL software.

Prior Accomplishments

- N.A.

Task 9 Study the influence of corrosion on ship life.

To be done the next and final quarter of this project.

Task 10 Final report.

To be done the next and final quarter of this project.

PROPOSED ACTIVITIES NEXT PERIOD:

1. **Task 8** Once initial runs of SAFEHULL are complete, a representative from ABS will be scheduled to visit UNO to provide guidance and answer any questions that may arise regarding the assumptions and procedures within the program itself.

2. **Task 8** Evaluation of the tanker according to the rules and also SAFEHULL will be ongoing at the same time and complete by early February.

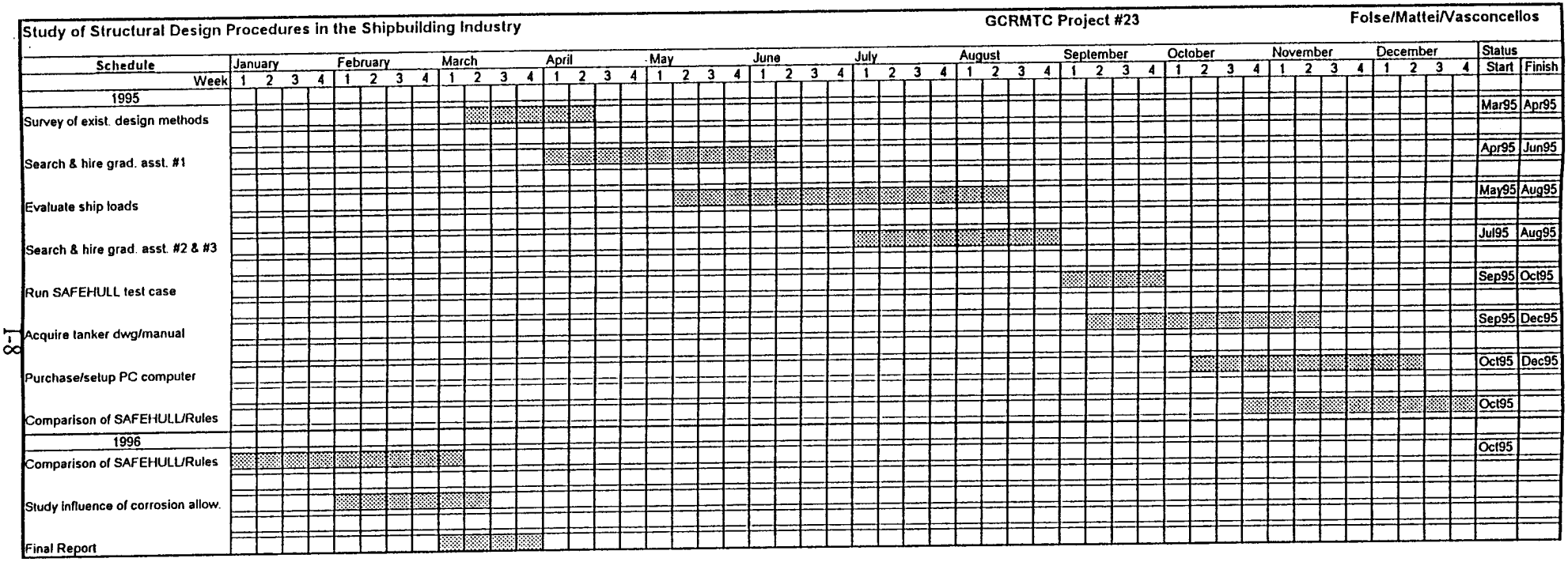
3. **Task 9** SAFEHULL will be used to study the effect of varying the corrosion allowance on initial costs versus additional ship life and reliability.

4. **Task 10** A final report will include a comparison of the two procedures, rules and SAFEHULL, as well as an examination of probability-based design and its potential impact on tanker design in the future. Also included will be recommendations for optimizing ship life with respect to corrosion resistance.

COLLABORATIVE EFFORTS:	THIS QTR	YTD
DOLLAR VALUE OF SERVICES FROM INDUSTRY		
IN KIND SERVICES:	$5000	$5600
ACTUAL FUNDS:	0	0
DOLLAR VALUE OF SERVICES FROM GOVERNMENT		
IN KIND SERVICES:	N.A.	N.A.
ACTUAL FUNDS:	N.A.	N.A.

NUMBER OF SIGNIFICANT CONTACTS		
INDUSTRY:	7	16
ACADEMIC:	1	3
GOVERNMENT:	2	3

COMMENTS: none


Study of Structural Design Procedures in the Shipbuilding Industry
GCRMTC Project #23
Folse/Mattei/Vasconcellos
Schedule
Week
January
February
March
April
May
June
July
August
September
October
November
December
1 2 3 4
Status
Start
Finish
1995
Survey of exist. design methods
Mar95 Apr95
Search & hire grad. asst. #1
Apr95 Jun95
Evaluate ship loads
May95 Aug95
Search & hire grad. asst. #2 & #3
Jul95 Aug95
Run SAFEHULL test case
Sep95 Oct95
Acquire tanker dwg/manual
Sep95 Dec95
Purchase/setup PC computer
Oct95 Dec95
Comparison of SAFEHULL/Rules
Oct95
1996
Comparison of SAFEHULL/Rules
Oct95
Study influence of corrosion allow.
Final Report

APPENDIX J

SOFTWARE APPLICATIONS FOR SHIPBUILDING OPTIMIZATION

GCRMTC PROJECT NO. AMTC95-027A

Principal Investigator: **Norman L. Whitley**
Department of Mechanical Engineering

Additional Researcher: **Stephen C. Lipp**
Department of Mechanical Engineering

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: This proposal calls for the investigation of current shipbuilding methodology and the incorporation of computer-based procedures in shipbuilding design and manufacture.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$185,389
FUNDS REMAINING:	$ 1,800

ACCOMPLISHMENTS THIS PERIOD:

Accomplishments to this date are divided into two categories:

1) tasks completed during the last quarter
2) tasks completed during the year.

TASK 1--Identify the State of Computer Usage in Design and Manufacturing Processes in the Shipbuilding Industry

Accomplishments October-December 1995

This task was completed in May 1995.

PRIOR ACCOMPLISHMENTS

CONCLUSION

Currently available large vertically integrated CAD systems are not a complete nor adequate answer to all of the problems of design in American Shipbuilding. They are part of the answer but all of them have problems.

Methods---Literature Review and Shipyard Interviews.

SYNOPSIS

The focus of this project has always been computer-aided design and manufacturing, althoug it has had various names. We remain committed to work that is consistent with the ideology of concurrent engineering (CE) or integrated product development (IPD). The focus was, in the beginning, broad and it was not clear what work would be appropriate work for the College of Engineering and have a great impact within the shipbuilding industry. Through interviews with shipyard personnel at various shipyards across the country as well as through the literature it can be seen that computers already play an important role in the design and manufacture of ships. It is also clear that there is room and need for many more computer-aided processes in these areas.

We decided not to survey shipyards on our own because of the numerous surveys that are sent their way each year. Response to outside surveys whether they are sponsored by NSRP or SNAME are typically poor. We felt justified in doing this because of the surveys that had been done recently, and the abundant literature that exists on the subject of using high-technology in design and manufacture.

We did visit, either in person or via the telephone, several shipyards of various sizes. What we found was that the larger yards have better representation in the literature than do smaller yards (their replies were consistent with the literature). Larger yards have more personnel that can be dedicated to being active in NSRP or SNAME. They more readily reap the rewards of the work being done by these professional groups and therefore are more likely to be active in them.

In interviews, we found mid-size and smaller yards to be different (their replies usually differed from the literature). They are interested in computer-aided processes, but not to the same extent as larger yards. They do not have the capital to spend on large vertically integrated CAD (LVICAD) systems and are not able to justify them in any cost/benefit analysis that make sense to them. Much of the work that they do can be done amply on 2-D CAD systems. That is changing somewhat but there remains the problems of legacy data in design. It is very difficult for a medium-sized yard to invest in a LVICAD system, invest in training and the unproductive transition period, and give up an enormous amount experience on some other CAD system and the legacy that goes with it.

TASK 2--Identify Other Areas Where Computers Can Play a Pivotal Role in Design and Manufacture

Accomplishments October-December 1995

This task was completed in June 1995.

PRIOR ACCOMPLISHMENTS

CONCLUSION

CAD systems alone will not make American shipyards more competitive. The sharing and use of information on an enterprise-wide basis is the crucial element to being competitive. Information management is a cornerstone to business success.

There is a lot of software available but most it is in the form of total package solutions. The total package solutions are not tailored to the shipbuilding industry and are not customizable to particular yards.

Methods---Literature Review, Shipyard Interviews, Software Survey

SYNOPSIS

After reviewing literature and interviewing personnel we performed an extensive survey of the software that is available in the areas of CAD and project/enterprise management. It is clear that the future of business success will entail information management on a level never before attempted. Various approaches to this problem are available and we felt it necessary to understand these solutions before we carried our research any farther. We firmly believe in the notion that it is a waste to re-invent the wheel.

There is a great deal of software available in the CAD area that is well known. In the area of project/enterprise management the software is less familiar but equally as plentiful. Many of these software solutions are extremely powerful and could be the answer is particular yards.

The consistent complaints that we heard in shipyards were: LVICAD systems although powerful are too inflexible, LVICAD systems are not tailored to shipbuilding, LVICAD systems would necessitate that we change the way do things, project management is done by manual methods that are not easily computerized, or by a hodge-podge of programs that are now finely tuned to our process and we do not believe that a canned program would do as well, total package solutions are too complex, too costly, demand too much infrastructure and too much expertise.

In short, for CAD and project management systems to be attractive they need to be, flexible, modular, able to be vertically integrated with various pieces of software from different vendors, and tailored on two levels---to the shipbuilding industry and to the yard.

We feel that object technology and object-oriented programming are emerging technologies that will have a tremendous impact on the way that computer solutions are written and maintained. These technologies will strongly impact productivity in the work place in the years to come. These technologies can provide all of the qualities that yards find attractive.

TASK 3--Identify Areas Where the University's Expertise Could Play an Important Role

Accomplishments October-December 1995

This task was completed in June 1995.

PRIOR ACCOMPLISHMENTS

We narrowed our focus to areas where the university can contribute its expertise. We identified four areas that are fundamental parts of the infrastructure needed to make CE a workable reality and which could overall greatly impact US shipyards ability to compete in the world market. They are: object-oriented computer-aided design systems, electronic data interchange, object-oriented project management and expert systems in standards.

Areas of Emphasis

1. Object-Oriented Computer-Aided Design Systems. We will demonstrate a CAD system that we will build using a C++ development environment (CAS.CADE from MATRA Datavision). The goal is create a CAD system that: is less expensive, is tailored to the shipbuilding industry and to specific yards, is modular, is based on object technology (integrable), can use legacy data, and can run on Intel type workstations in a networked client/server environment.

2. Electronic Data Interchange. We will investigate and then educate and support the use of the Internet to do secure, reliable, and cost-effective electronic interchange of technical data and business information.

3. Object-Oriented Project Management. We will demonstrate a project management system that we will build using a SmallTalk development environment (VisualWorks from ParcPlace/Digitalk). The goal is create a system that: is less expensive, is tailored to the shipbuilding industry and to specific yards, is modular, is based on object technology (integrable), and can run on Intel type workstations in a networked client/server environment.

4. Expert Systems in Standards. We will investigate and demonstrate the use of an expert system that will help designers comply to various commercial standards during the design process.

TASK 4--Establish a Laboratory That Provides a Typical Environment for Development of Useful Software (The Advanced Computer Laboratory for Shipbuilding--ACLS)

Accomplishments October-December 1995

This task continues as the project progresses. This quarter, a DEC Alpha-station 250 running Digital Unix (which will change over to Windows NT in the summer) was added to the network.

PRIOR ACCOMPLISHMENTS

RESULT

Purchased hardware and software. The Lab was established with 4 Pentium 90 machines networked with Windows NT.

Methods---Literature Review and Shipyard Interviews, Purchasing

SYNOPSIS

Through our information gathering it was established that these general trends are true: There is a movement away from main-frame computers. There is a movement toward high-end PC workstations. There is a movement toward networking. There is a general avoidance of the UNIX operating system.

The ACLS reflects these trends. A variety of networking systems was found but we believe that Windows NT will be a dominant player in the years to come, especially with the collapse of the Open Software Foundation. Shipyards prefer Microsoft Windows as an operating system for they view it as ``easy."

In the coming year the line between workstation and personal computer will continue to blur. Our lab is equipped with machines of both types that can do CAD and computation-intensive operations in a reasonable way.

TASK 5--Select Software Tools for Development

Accomplishments October-December 1995

Purchased VisualWorks (Smalltalk), and CAS.CADE CAD Development environment, and some peripheral software for code/expert system development. Created baseline for CAD software testing by modeling a machinery room for a naval frigate in AutoCAD 13 and CADkey 7.2.

PRIOR ACCOMPLISHMENTS

Method---Literature and Software Survey, Purchasing

RESULT

The ACLS has these software components: CAS.CADE, VisualWorks 2.0, CADKEY 7.2 Professional, AutoCAD 13, and various supporting application packages.

SYNOPSIS

Object Technology is emerging as a powerful tool in information management and data structureutility. It is not being used adequately in currently available design systems. We are approaching each of our individual components as a part of the whole, and therefore each component shall have as its essential characteristic objects which can be used by all other components.

The development of a CAD system using object-oriented programming environment will allow for flexibility, modularity, and integration. It will also allow customization to the industry.

The AutoCAD 13 and CADKEY 7.2 are in the ACLS for relevant comparisons. Many shipyards use low-end CAD products such as these and it will help us in our development to understand how things are done now, and how users can sensibly migrate from where they are to the more robust object environment.

TASK 6--Pursue Areas Where the University's Expertise Could Play an Important Role (Reference TASK 3)

CAD Development---With the purchase of CAS.CADE from Matra Datavision, four days of training have been accomplished during the previous quarter. Further training is presently being scheduled.

Electronic Data Interchange---Our progress on this front has not been satisfactory. It was our choice to select the Electronic Commerce Resource Center at Orange, Texas to be a primary source of information as well as a developer of course material for workshops on the use of EDI in shipbuilding. That, frankly, has not worked. Although the ECRC/Orange continually promised to supply us with both state-of-the-art information and workshops on the use of EDI in manufacturing and business enterprise it has not. After dealing with numerous people at the ECRC/Orange we have received no more than a packet of articles that were gleaned from various sources. In all honesty, we could have found the same articles without their help and in less time.

Object-Oriented Project Management---This task has begun with the purchase of VisualWorks by ParcPlace, Inc.

Expert Systems in Standards---Familiarity with the tools for expert system development (CLIPS, Symantec C++, VisualParse++) is being acquired through sample programming tasks.

It had been previously determined through literature search and personal interview the proper tact to develop an expert system for shipbuilding standards. Basically, it is a three-step plan: (1) parse a set of shipbuilding standards into a relational database format; (2) parse a 3-D solid model of a ship into a relational database format; and (3) compare the two databases with an artificial intelligence (AI) tool.

PROPOSED ACTIVITIES NEXT PERIOD:

TASK 1--Standards/Materials Acquisition

a. Acquire U. S. Coast Guard standards for commercial shipbuilding.

b. Acquire STEP.

c. Acquire DXF (Autodesk Data Exchange Format) description.

d. Acquire CAD library from representative shipyards.

TASK 2--Code Generation

Generate object code for:

a. Preliminary DXF to STEP conversion. Contingent upon completion of TASK 1 b and c.

b. Interference checking in 3-D solid models.

c. Preliminary DXF to Parametric model conversion. Contingent upon completion of TASK 1 c.

TASK 3--Expert System Development

Develop algorithms/methods/code to parse USCG standards for commercial ships into a database for computer querying. Contingent, though not entirely, upon completion of TASK 1 a.

TASK 4--CAD Development Training

Attend eight more days of CAS.CADE training.

TASK 5--Electronic Data Interchange

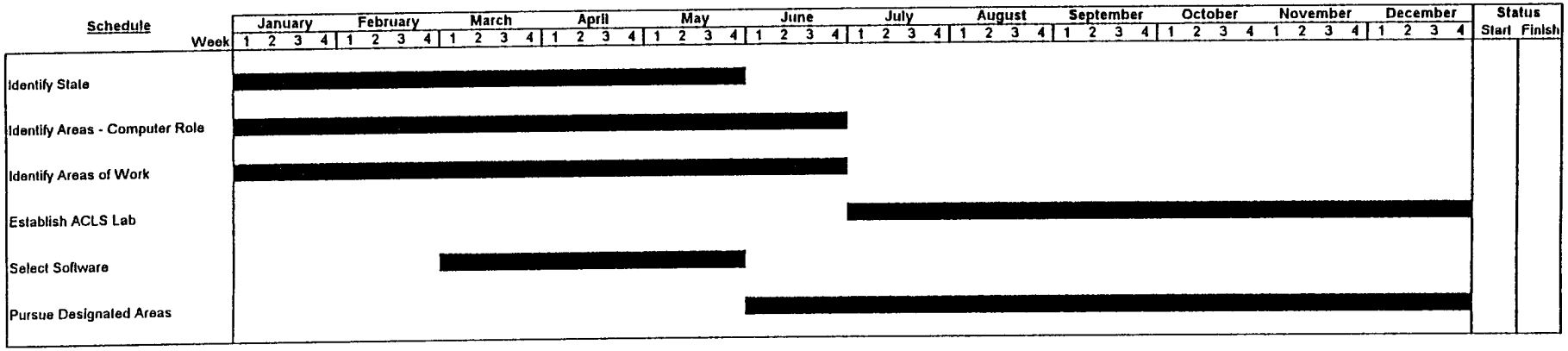
We have decided to pursue this work in collaboration with NSnet. NSnet is a network (that is part of the Internet complex) that is funded by Maritech. In the statement of their long term vision it is stated, ``The next phase involves expanding the system so that it provides all of the tools and capabilities needed to perform electronic commerce.'' In discussion with Mike Ferguson of Maritech/PRC (who runs NSnet) it is clear that a collaborative effort would be most prudent and productive and we will pursue this in the coming quarter. Our goal is to demonstrate that EDI can be done via the Internet and that it is secure, reliable, and cost effective.

TASK 5--Trips

CAD Workshop and 1996 SNAME Ship Production Symposium: San Diego, CA, February 12-16.

SP-4 Meeting, Newport News Shipbuilding, March 6-7.

COMPUTER - AIDED DESIGN AND MANUFACTURING - 1995



RESEARCH STUDY WORK SCHEDULE

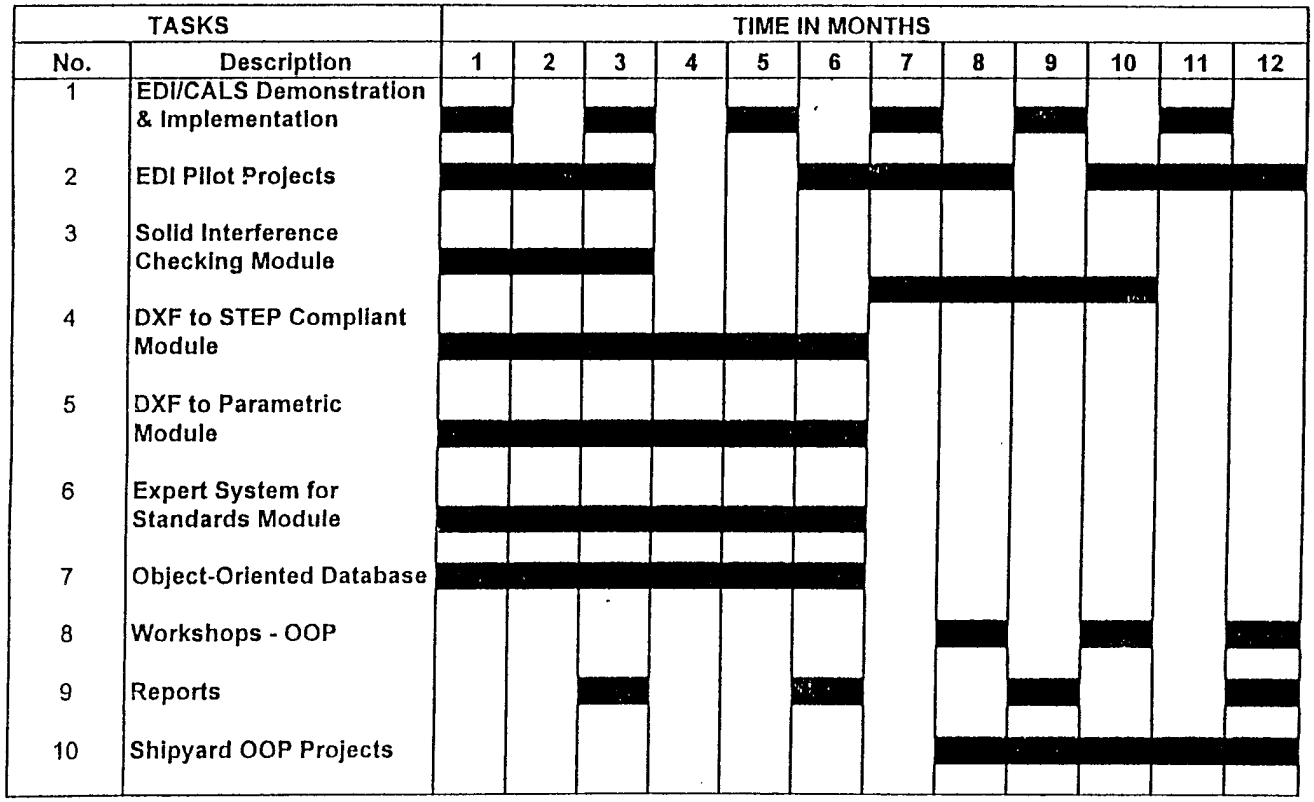


Figure 2-6

APPENDIX K

IMPROVING TECHNOLOGY TRANSFER IN THE SHIPBUILDING INDUSTRY

GCRMTC PROJECT NO. AMTC95-030A

Principal Investigator: **William Lannes, P.E.**
College of Engineering

Co-Principal Investigator: **James Logan, Ph.D.**
College of Business, Department of Management

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: The purpose of this project is to develop an improved technology transfer process, incorporating change management techniques, for use in the shipbuilding industry. The deliverables from this project consist of an improved technology transfer process, incorporating industry best practices and current knowledge of organizational change into a matrix evaluation model, and its accompanying implementation protocol. The process incorporates financial, technical, and behavioral factors into a normative model designed to enhance organizational technology transfer. The model is for use by firms in the shipbuilding industry to evaluate current firm practices against best practices and to identify target areas for improvement within a firm. The improved process model identifies significant stakeholders in the technology transfer process and incorporates their needs. The model is customizable to individual firm requirements to insure maximum usability. Additional benefits of this project are the generation of a current, focused data base on the subject of technology transfer in the shipbuilding industry, and increased understanding within both the College of Business and the College of Engineering at the University of New Orleans of a very significant regional industry.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$127,569
FUNDS REMAINING:	$ 5,900

ACCOMPLISHMENTS YEAR TO DATE

Task 1 - Global literature review and initial interview instrument development.

Accomplishments Oct. - Dec. 1995
- This task was completed in March, 1995.

Prior Accomplishments
- Determined literature and electronic data sources that could be of use in this project.
- Organized data into electronic data base format usable for this project.
- Developed initial interview format and presented to industry representatives.
* See attached listing of data base resources.

Task 2 - Initial field interviews to establish validity of industry structure model.

Accomplishments Oct. - Dec. 1995
- This task was completed in April, 1995.

Prior Accomplishments
- Initial field interviews to validate industry structure.
- Initial field interviews to validate overall concept and need.

Task 3 - Initial survey instrument development and pretest.

Accomplishments Oct. - Dec. 1995

- This task was completed during July, 1995.

Prior Accomplishments

- Drafted questions using team experience and industry participant feedback.
- Developed questions that addressed specific areas of shipyard industry structure.

Task 4 - Identification of target population and survey sample.

Accomplishments Oct. - Dec. 1995

- This task was completed August, 1995.

Prior Accomplishments

- Obtained listing of all U.S. and foreign shipyards
- Obtained listing of technical personnel at U.S. shipyards
- Obtained listing of all Louisiana shipyards and personnel
- Created merged data file of survey sample from the above sources to use in survey mailout.

Task 5 - Survey of sample population.

Accomplishments Oct. - Dec. 1995

- Initial survey mailed to 640 potential respondents in 121 shipbuilding firms
- 72 respondents to date, second mailing to those who did not respond is ready to be mailed

Task 6 - Analysis of initial data.

Accomplishments Oct.- Dec. 1995.

- Initial data analysis to determine impact on hypothesized technology transfer model
- Data entry to enable cluster analysis to confirm important industry structural variables
- Determination of shipbuilding industry participants with high performing technology transfer programs

Task 7 - Development of prototype model and protocols for usage.

Accomplishments Oct. - Dec. 1995

- Development of expert system prototype (SHIPTECH) to include prior hypothesized relationships and knowledge gained from initial surveys.

- Refine expert system prototype and develop initial protocol for use in shipyards.

Prior accomplishments

- Obtain and study expert systems related to technology transfer.
- Develop expertise in using C++ programming language in this context.

Task 8 - Identification of industry partners for year two of the project.

Accomplishments Oct. - Dec. 1995

- The addition of two industry partners for the proposed second year of the project: Manager of Advanced Technology for Ingalls Shipbuilding, Raymond Johnston, and two project managers for McDermott Shipbuilding, Doug Smith and Tom Brown. These individuals will provide valuable insight to the project as well as provide test sites for the protocol and model developed with this project. They will be involved with testing the model against past successes and failures of innovation as well as with new innovation implementation.

PROPOSED ACTIVITIES NEXT PERIOD

1. Analysis of data gathered from survey - We will continue mailing surveys and follow-up on survey nonresponse during the next quarter. As the responses are received, they are logged and the data entered into our data base. We have done an initial analysis of the responses, but are postponing more exhaustive statistical analysis until the second round of responses are received. The majority of this work should be done by the end of next reporting period, unless the surveys lead us to examine an area we had not anticipated.

2. Design of overall measurement model for technology transfer based on survey results - As the survey results are analyzed, we can incorporate the results of the survey into our hypothetical technology transfer model. If so, we can then move on to step 3, below.

3. Test of model against past technological innovation with industry partners to determine predictive ability and refine measurement capability. We will work with industry partners to determine if our model is congruent with the technology transfer process as it occurred in past instances. If so, we will work with industry partners and other GCRMTC projects to evaluate the model and protocol under field conditions.

4. Preparation of scholarly paper detailing work done on project to date to include significant findings. The findings of this project should be reported in the engineering and management scholarly publications. However, the primary purpose of this project is to work with industry partners to improve the technology transfer process.

5. Recruitment of additional (volunteer) industry participants to test prototype model. These will be participants in GCRMTC projects as well as interested participants in the shipbuilding industry.

COMMENTS:

This project is congruent with the designated thrust areas from the February, 1995, GCRMTC workshop, in that it is directly about ***catalyzing change within the maritime industry***. The second year of funding is necessary to work with the industry participants and other GCRMTC researchers to implement the model and make iterative changes that will customize the model to individual strategic groups. The model test stage is designed to work with industry participants as they actually implement technological innovations within a firm. This project was originally planned as a two-year project in order to work with shipbuilding industry participants and insure usability of the research model under field conditions.

COLLABORATIVE EFFORTS	**THIS QTR**	**YTD**
$VALUE OF SERVICES FROM INDUSTRY:		
INKIND SERVICES:	–	$20,000.00 *
ACTUAL FUNDS:	–	–
$VALUE OF SERVICES FROM GOVERNMENT:		
INKIND SERVICES:	–	–
ACTUAL FUNDS:	–	–
# OF SIGNIFICANT CONTACTS:		
INDUSTRY:	54**	115**
ACADEMIC:	4	15
GOVERNMENT:	3	10

COMMENTS TO EXPLAIN ABOVE:

* Estimate of value of time donated by firms who made executives available to us for interview and discussion.

** We mailed out over 600 surveys. These numbers include the 72 returned surveys obtained so far, plus other significant contacts in industry. We will mail out approximately 525 additional surveys as a follow up in the early part of next quarter.

Attachment 1

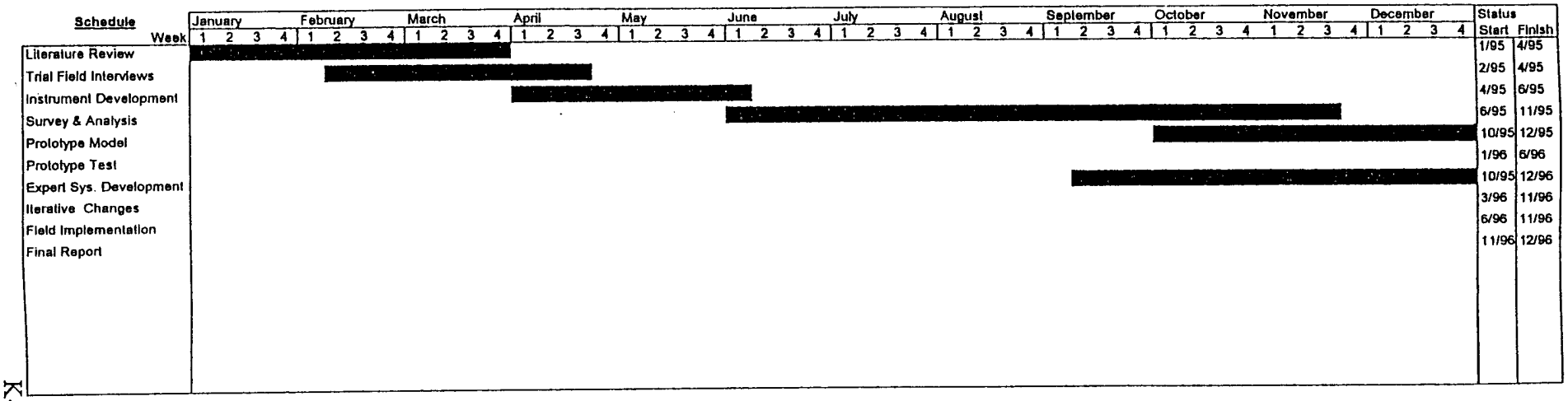
Technology Transfer Index

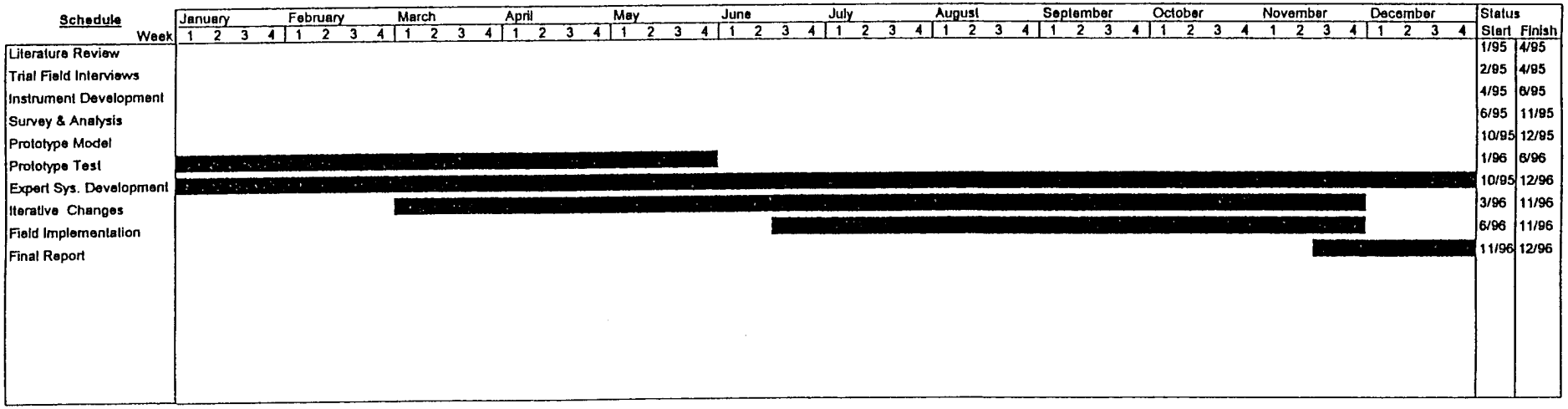
GCRMTC Project 30

FILENAME	SUBJECT	REFERENCE
shipfinc.txt	SIC Code 3731	CD Disclosure
noship.wk3	NO shipyards	DBER data
ship.wk3	LA shipyards	DBER data
Shipb.ab1	Shipbuilding	ABI Jan 92- Dec 94
Shipb.ab2	Shipbuilding	ABI Jan 87- Dec 92
Shipb.fd1	Shipbuilding	M Archive
Shipb.p1	Shipbuilding	Periodicals Sep 93-Dec 94
Shipb.p2	Shipbuilding	Periodicals Jan 92-Aug 93
Shipy.ab1	Shipyards	ABI Jan 92-Dec 94
Shipy.ab2	Shipyards	ABI Jan 87-Dec 92
Shipy.p1	Shipyards	Periodicals Sep 93-Dec 94
Shipy.p2	Shipyards	Periodicals Jan 92-Aug 93
Shipy.p3	Shipyards	Periodicals Jan 90-Dec 91
Shipy.p4	Shipyards	Periodicals Jan 88-Dec 89
Ships.adr	Shipyards	Shipyard Addresses
Techx.fd1	Technology Transfer	M Archive
Techx.p1	Technology Transfer	Periodicals Sep 93-Dec 94
Techx.p2	Technology Transfer	Periodicals Jan 92-Dec 94
Techx.p3	Technology Transfer	Periodicals Sep 93-Dec 94
Techx.ab1	Technology Transfer And Marketing	ABI Jan 89-Apr 95
Techx.ab2	Technology Transfer And Engineering	ABI Jan 89-Apr 95
Techx.ab3	Technology Transfer	ABI Jan 89-Apr 95
Shiptech.src	Internet Sources	Various
Reports.txt	Project Reports	Project 30

This is an index of the current holdings in the Project 30 data base. They are the result of researching as much information about shipbuilding, shipyards, technology transfer, and related subjects as was available, retaining the best of the information, and recording that information into electronic format. We are also making available any work products of the Project 30 team that could be useful to industry participants. The information is generally available either as a text or common word processing program language, or Lotus format spreadsheet. We are making this available to industry partners and any other interested parties.

Title THE USE OF CHANGE MANAGEMENT TO IMPROVE TECHNOLOGY TRANSFER IN THE SHIPBUILDING INDUSTRY - PROJECT 30





APPENDIX L

DIGITAL IMAGE PHOTOGRAMMETRY

GCRMTC PROJECT NO. AMTC95-035A

Principal Investigator: **Clifford J. Mugnier**
Department of Civil and Environmental Engineering

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: A problem in modular shipbuilding is the lack of a reliable and quick method of obtaining and utilizing dimensional control. Photogrammetry has been successfully used as a tool for this application, but because of the large number of systematic errors associated with film-based cameras; only very large shipyards have attempted this. Recently, developments in Charge Coupled Device (CCD) imaging arrays for cameras have allowed some success in applying photogrammetric techniques *without film* in dimensional control. The software and hardware configurations have been expensive and complicated. Digital camera systems and computers will be purchased and programmed to tie existing inexpensive software packages originally designed for mapping into a tool for production shipyard fabrication dimensional control.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$327,017
FUNDS REMAINING:	$ 76,761

ACCOMPLISHMENTS YEAR TO DATE:

TASK I - Industry survey of Instrumentation & Techniques in Accuracy Control

Accomplishments Oct-Dec95

- The survey task was completed in Sept95.
- Survey results were presented at the SP-8 Workshops in Norfolk (Oct 4-5), New Orleans (Oct 12-13), and San Diego (Oct 23-24) with some vendor exhibits.

Prior Accomplishments

- Shipyards participating included: Avondale, Charleston Naval, Norfolk Naval, General Dynamics, Newport News, Ingalls, NASSCO and Bath Iron Works.
- Defense Technical Information Center (DTIC) literature search completed with zero references found pertaining to accuracy control in shipbuilding.

TASK II - Software development & integration

Accomplishments Oct-Dec95

- All systems are operational and in use. Standard Topographic Mapping software selected and purchased does work in "Industrial Photogrammetry Mode".

TASK III - Field Implementation & integration

Accomplishments Oct-Dec95

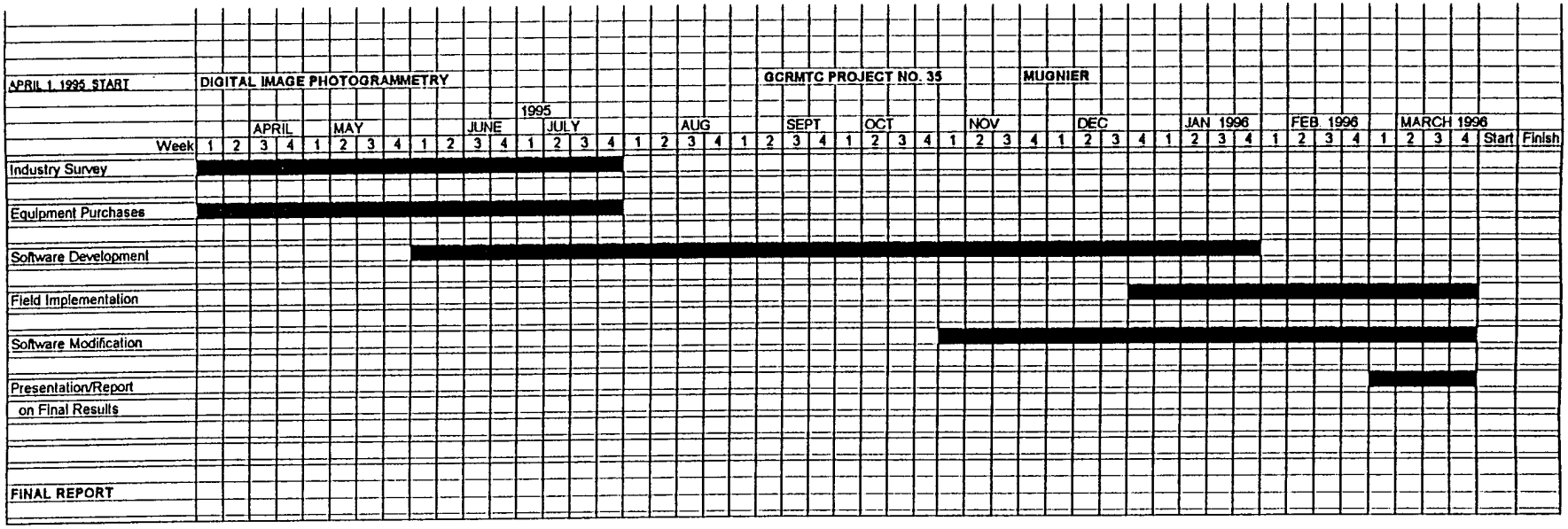
- Tour of Avondale Shipyards completed Dec95.
- Imagery (digital photos) obtained of Double Hull Tanker mid-body section.
- Imagery obtained of model of Shell Bolster for AHLK C5-080 ship.
- Radio Remote control electronics successfully modified by COE Technician.

PROPOSED ACTIVITIES NEXT PERIOD:

TASK IV - Software modification & presentation/report on final results.

COLLABORATIVE EFFORTS:

COMMENTS: Active participation with Avondale Shipyards commenced the last week of the 3rd Quarter. Three (3) separate Digital Photogrammetry applications have been initiated at the request of Avondale. Substantial progress is anticipated for collaboration in this fourth quarter including photogrammetric training of mid-level engineering management. Collaborative efforts have been facilitated through the assistance of A.K. Suda & Associates, Inc.


APRIL 1, 1995 START
DIGITAL IMAGE PHOTOGRAMMETRY
GCRMTC PROJECT NO. 35
MUGNIER
1995
APRIL
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN 1996
FEB 1996
MARCH 1996
Week
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 Start Finish
Industry Survey
Equipment Purchases
Software Development
Field Implementation
Software Modification
Presentation/Report
on Final Results
FINAL REPORT

APPENDIX M

SHIP CAPSIZING (AN ACCURATE AND EFFICIENT TECHNIQUE TO PREDICT SHIP ROLL DAMPING)

GCRMTC PROJECT NO. AMTC95-036A

Principal Investigator: **Dr. Jeffrey M. Falzarano**
Department of Naval Architecture and Marine Engineering

Additional Researcher: **Dr. Richard A. Korpus**
Marine Hydrodynamics (SAIC, Ship Technology)

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: This project will develop an accurate and efficient technique to predict ship roll damping using the Finite Analytic Reynolds Averaged Navier Stokes (FA-RANS) solution technique. This capability will be used to improve naval and commercial hull form design with regards to minimizing the most critical resonant roll motions and loads. The approach to be utilized will be to apply progressively more accurate yet computer intensive approximations. Comparisons will be made with existing results and data to be obtained model and full scale tests. Extensive use will be made of existing SAIC capability and UNO experimental and computer resources including the newly installed UNO Cray J916.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$187,010
FUNDS REMAINING:	$ 38,428

ACCOMPLISHMENTS YEAR TO-DATE:

Task I Development of 2-D without Free Surface RANS Capability
Accomplishments Oct-Dec 95
- Improved stability properties of RANS code for high Reynolds number (i.e., full scale barge with wide beam). Undertook comparison of small model, large model and full scale cases.
Prior Accomplishments
- Completed suitable laminar flow representative hull form test case including an automated gridding program.

Task II Development of Bilge Keel Gridding Capability
Accomplishments Oct-Dec 95
- Comparison of equivalent barges with and without bilge keels cases
Prior Accomplishments
- The with bilge keels gridding capability has been successfully developed and tested.

Task III Development of 2-D with Free Surface Capability
- Began work on nonlinear interpolation scheme.
Prior Accomplishments
- Began development of the fully nonlinear free-surface viscous boundary condition including no-shear stress on the surface.

Task IV Development of Unsteady Potential Flow
Accomplishments Oct-Dec 95
- Investigated incorporation of shedding capability into unsteady potential flow code.

Prior Accomplishments
- The unsteady panel method including an automated panelization program has been developed and utilized. A procedure to utilize the results of the RANS and unsteady ideal flow codes to derive the viscous contribution to the roll damping was developed. These results will be useful to naval architects using potential flow computer programs to better predict the roll damping and vessel response.

Task V Systematic Series
Accomplishments Oct-Dec 95
- Work was initiated predicting damping of McDermott wide-beam jacket type barge.
Prior Accomplishments
- A frequency and amplitude variation of a single representative hull form was completed.
- For the 2-D with a free-surface case, we will produce a wall-sided, no dead-rise, with bilge radius systematic series. The following six parameters will be varied: 1) Beam/Draft, 2) bilge radius/Draft, 3) motion frequency, 4) roll center (roll and sway), 5) bilge keel size, and 6) motion amplitude.

Task VI Collaboration with Industry
Accomplishments Oct-Dec 95
- Discussed with Mr. Mukerjee (Chief Naval Architect of McDermott Offshore) regarding McDermott's participation in next phase. We envision one of Mr. Mukerjee's staff naval architects using the developed capability to predict the roll damping of one of McDermott's semi-submersible crane vessels and comparing that with available model test results.
Prior Accomplishments
- Met with Mr. Mukerjee in order to obtain his input on the parameters and range of parameters of our systematic series.

PROPOSED ACTIVITIES NEXT PERIOD:

During the next period we will begin work on the next year's tasks which include work in three areas, i.e., development, applications and validation.

1) Development:
Continue with 2-D free-surface capability, begin 3-D unsteady and 3-D unsteady with forward speed.

2) Applications:
Continue extending systematic series and begin undertaking a McDermott application including comparison with model tests results that they have available.

3) Validation:
During the second year we intend to undertake model tests to compare with our numerical results. These comparisons will include global force comparisons and flow details. We also plan to undertake some full scale comparisons with a McDermott vessel when one is available.

COLLABORATIVE EFFORTS:

$ VALUES OF SERVICES FROM INDUSTRY:

IN KIND Cray C-90 time from SAIC 40hrs@$400/hr=$16,000
and Cray C-90 time from Cray Research 100hrs@$400/hr=$40,000
ACTUAL FUNDS (none)

$ VALUES OF SERVICE FROM GOVERNMENT:

IN KIND (none)
ACTUAL FUNDS (none)

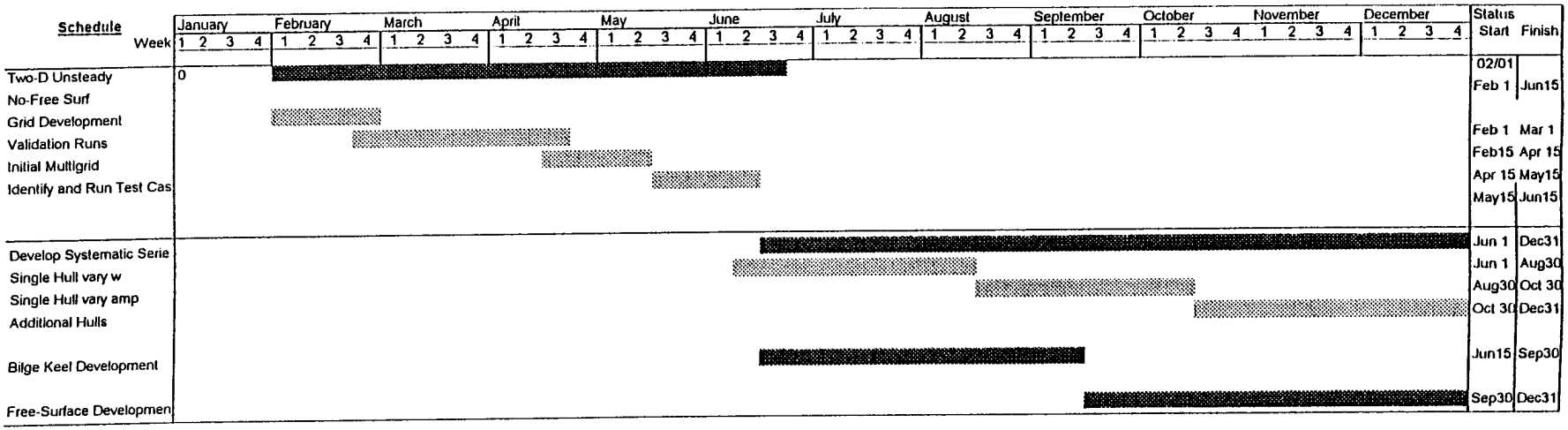
OF SIGNIFICANT CONTACTS

INDUSTRY: Mr. Mukerjee (McDermott Offshore) (10hrs @$160/hr=$1600),
Dr. Kokinias (Exxon PR)
ACADEMIC Prof. Yeung (UC Berkley), Prof. Cheung (Univ. of Hong Kong)
GOVERNMENT H. Chatterton (NAVSEA), B. McCrieght (DTRC)

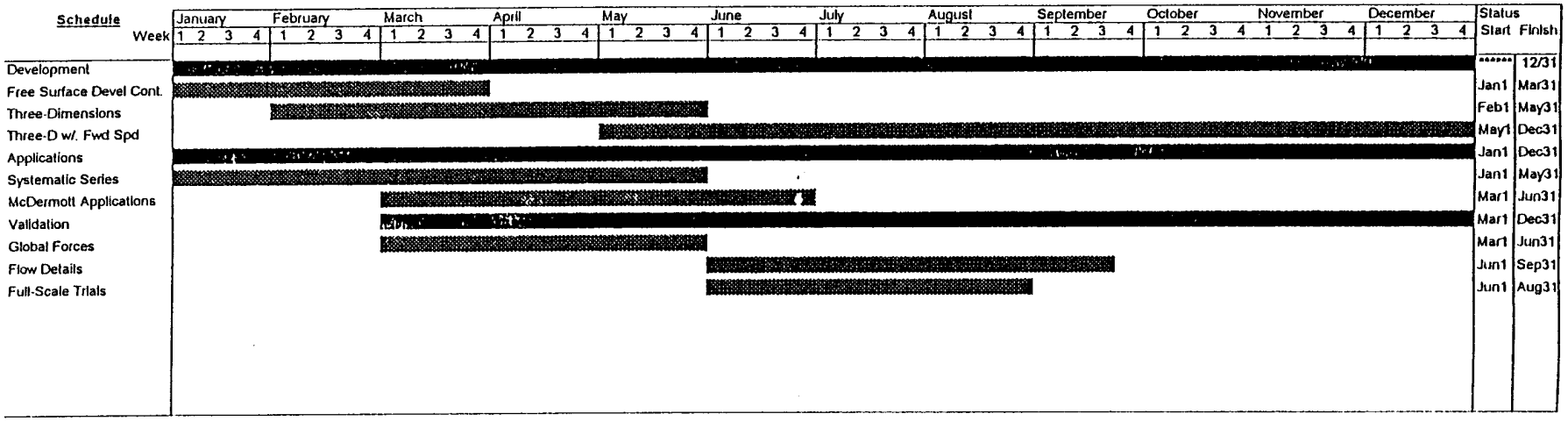
COMMENTS (to amplify, explain or add to above)

We envision finalizing most of the above first year tasks during the next few months. We are somewhat behind schedule with regards to the basic 2-D without a free surface development tasks (see attached time line). However, the 2-D with a free-surface and development of a systematic series represent slight deviations from the original plan in order to facilitate, more efficient completion of future tasks and make the results more widely available and practically useful.

Ship Capsizing (An Accurate & Efficient Technique to Predict Ship Roll Damping)



Improvment of Roll Motion Characteristics



APPENDIX N

MOTION SICKNESS AND ANTI-MOTION SICKNESS TREATMENT

GCRMTC PROJECT NO. AMTC95-099A

Principal Investigator: **Thomas G. Dobie**
Department of Psychology

Additional Researcher: **James G. May**
Department of Psychology

University of New Orleans
New Orleans, LA 70148

PROJECT SYNOPSIS: Motion sickness and related illness impair performance of Navy personnel and often result in a complete inability to carry out an assigned task. *Naval Medical Information Management Center* data from a recent fifteen month period show that, on ships ranging from nuclear-powered aircraft carriers to repair ships, enlisted men incapacitated due to motion sickness cost the Navy $135,000.00 in lost man days. This does not include additional costs of medication and medical monitoring. Motion-produced vestibular stimulation also greatly affects sleep, often inducing severe fatigue which is a concern for sustained operations. To remedy these and other problems, the current project is aimed at validating a cognitive-behavioral anti-motion sickness training program developed at the Naval Biodynamics Laboratory by Dr. Thomas G. Dobie.

Our primary goal is to offer an intervention and management strategy for U.S. Navy personnel exposed to motion environments. Validation involves training others to employ the technique and testing their ability to use it. Upon validation of the cognitive-behavioral program, we will begin to transition the technique to an appropriate field operational setting through the use of Technology Transfer channels. A secondary goal is to develop predictors of motion sickness that might be used in personnel selection.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$100,000
FUNDS REMAINING:	$ 29,819

Note: Due to the time required to receive a work permit ("green card"), Dobie's arrival was delayed. A no-cost six month's extension to the contract has been received.

ACCOMPLISHMENTS THIS PERIOD:

Task #1: Develop Training Program for CBMT Trainers:

a) Work has continued on the preparation of a "Handbook of Cognitive-Behavioral Training", for use by trainers. NBDL has decided upon the final format required which will take the form of two documents. A reference manual on the subject of motion sickness and its management, plus a manual for counselors wishing to carry out cognitive-behavioral anti-motion sickness training. It is planned to complete these two documents ready for printing during the next quarter.

b) A suitable site has been identified at UNO for the location of the new mechanical desensitization training device. However it has been decided to delay the transfer until further

acceptance checks have been completed on-site at NBDL. These will include subject training runs during validation studies at NBDL (see Task #2).

Task #2: Assist in Technology Transfer of the CBMT Program:

a) In the last quarterly report it was it was recorded that a patrol craft unit based on the west coast, in San Diego, had severe problems with motion sickness. Four crewmen suffering from severe motion sickness have been sent from there to NBDL and are currently undergoing cognitive-behavioral training under the supervision of Dr. T. G. Dobie. This training will be completed during the first week of February.

b) In the last report it was also noted that the question of the treatment of trainee aviators at Whiting Field, who are suffering from airsickness was under discussion with NAMRL Pensacola. This matter is still under review by staffs at Whiting Field and NAMI/NAMRL, Pensacola, concerning future treatment plans and what contribution we can make. The second meeting to which reference was made in the last report has not yet taken place, but we understand that they are still interested in the possibility of these trainees being given our cognitive-behavioral anti-motion sickness training.

Task #3: Assist in Construction of a Selection Tool on Motion Sickness

We are continuing to review the problems found by NBDL during the joint International CANUKUS studies (Canadian, United Kingdom, United States), on the SMS with the Human Factors Group at NBDL. The review of literature on this matter continues and we will remain in touch with European and American psychologists in this field. No major changes have taken place this quarter.

As far as an evoked potential index of motion sickness is concerned, we are standing by to review any results forwarded by NBDL; as yet, none have been received. This is still the case and the serious reduction in the number of human research volunteers at NBDL means that further data is unlikely to be forthcoming.

Task #4: Personality:

This project continues as a literature survey to obtain existing information on the relationship between motion sickness and personality profiles prior to carrying out investigative trials. In addition NBDL is now advising on their input into this, based on previous work carried out by one of their aviation psychologists.

The main advance in this area is that the four subjects currently undergoing cognitive-behavioral training at NBDL (Task #2a), have completed 7 specially selected personality tests so as to evaluate any significant relationship between these findings, motion sickness susceptibility and response to desensitization.

PROPOSED ACTIVITIES NEXT PERIOD:

We shall complete the cognitive-behavioral anti-motion sickness training of the motion sick subjects from the west coast patrol craft unit, who are currently at NBDL. There is also the possibility that they may be willing to send further subjects next quarter to NBDL for this purpose.

The data obtained from the personality tests will be analyzed and evaluated in terms of any relationship between those variables and motion sickness susceptibility.

There has been no further information regarding the availability of potential navy counselors for training in the use of cognitive-behavioral therapy, although interest has been shown by potentially suitable candidates in San Diego.

We will complete the reference book on motion sickness and its management as well as the handbook on cognitive-behavioral counseling.

We will complete the literature review on motion sickness and screen the updated putative personality tests for test-retest reliability, as soon as they are received from NBDL.

We hope to finalize a contract with Glaxo Wellcome Inc. To carry out an evaluation on the effectiveness of "ondasetron" as an anti-motion sickness drug. This is an FDA approved anti-emetic used to control nausea and vomiting induced during cancer therapy. The trials will take place at NBDL using the ship motion simulator. The PI for this proposed study will be James G. May, and Thomas G. Dobie will be the experimenter. We await Navy approval of a CRADA before trials can begin.

COLLABORATIVE EFFORTS	THIS QTR	YTD
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:		
ACTUAL FUNDS:	$200,000	$200,000
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:		
ACTUAL FUNDS:		
# OF SIGNIFICANT CONTACTS:		

INDUSTRY: Glaxo Wellcome Inc.; Smooth Sailing Co.

ACADEMIC: United Kingdom Medical Research Council, psychologists and human factors researchers.
GOVERNMENT: International CANUKUS (Canadian, United Kingdom, United States) Human Factors research group. NAMI/NAMRL, USN Pensacola; Landing Craft Air Cushion (LCAC) Squadron, Norfolk Va., Patrol Craft Squadrons, San Diego, CA.

COMMENTS: Regarding contacts with industry, we are currently negotiating a contract with Glaxo Wellcome to carry out a drug study. We have also been contacted by Smooth Sailing Co. with a view to evaluating a beverage they market as a motion sickness preventive. A preliminary meeting has been scheduled for 3 November.

Motion Sickness and Anti-Motion Sickness Treatment

1995

Schedule	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Status
Week	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	S/F
Task 1													2/95 12/95
Task 2													7/95 12/95
Task 3													3/95 12/95
Task 4													4/95 12/95

1996

Schedule	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Status
Week	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	1234	S/F
Task 1													1/96 3/96
Task 2													1/96 3/96
Task 3													1/96 3/96
Task 4													1/96 3/96

Task #1: Develop Training Program for CBMT Trainers
Task #2: Assist in Technology Transfer of the CBMT Program
Task #3: Assist in Construction of a Selection Tool on Motion Sickness
Task #4: Personality

TASK II: Programming

Accomplishments Oct-Dec95

- Front end of the graphics has been completed, and programming for that has been started.

Prior Accomplishments

- None.

TASK III: User Interface

Accomplishments Oct-Dec95

- Programming for printing the user data, and making configuration to the server is underway.

Prior Accomplishments

- None.

PROPOSED ACTIVITIES NEXT PERIOD:

TASK IV: Work will begin with porting the server software for DEC OS/1, SunOS.

TASK V: Continue testing the Beta version of Server on SGI/HP machines. Final version of the software should be done by end of February, 1996

COLLABORATIVE EFFORTS:

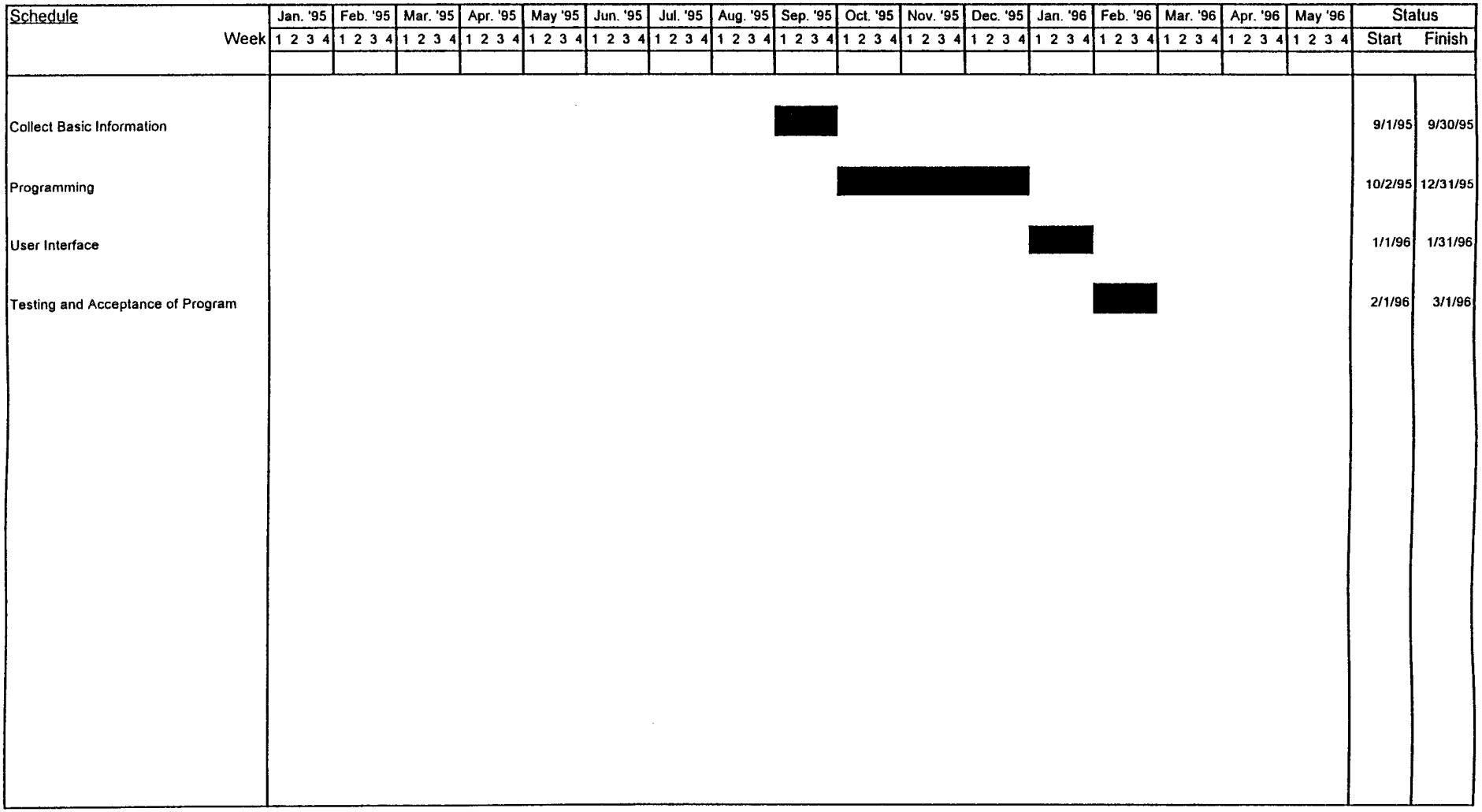
	THIS QTR	YTD
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:	n/a	n/a
ACTUAL FUNDS:	n/a	n/a
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVCIES:	n/a	n/a
ACTUAL FUNDS:	n/a	n/a

OF SIGNIFICANT CONTACTS:

INDUSTRY:	n/a
ACADEMIC:	n/a
GOVERNMENT:	n/a

COMMENTS: None.

CPU Usage in a Distributed Network Billing Project



APPENDIX P

BUSINESS PROCESS IMPROVEMENT
GULF COPPER MANUFACTURING, INC.

GCRMTC PROJECT NO. OR95-OO1A

Principle Investigator: **Patricia R. Pate**
Gulf Cost Region Maritime Technology Center

Lamar University
Orange, TX 77630

PROJECT SYNOPSIS: This project focuses on improving turnaround time on ship repair projects with a Gulf Coast Manufacturing firm. Key issues of the project include improving throughput of repair/conversions, assessing the organizational environment, culture, team participation, and current quality initiatives. Using simulation software, baseline process models will be developed which characterize the current approach to the bid process, planning, materials acquisition, and project management. The Stolt Parcel Tank Modification Project was chosen as the initial project for study. Data has been gathered through the project team, interviews, and team work sessions. Comparisons of the actual model will be conducted with various "what-if" scenarios.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$134,719
FUNDS REMAINING:	$42,912

ACCOMPLISHMENTS YEAR TO DATE:

TASK I: Establish Project Team.

Accomplishments Oct-Dec95

- Met on a weekly basis to discuss internal and external operating parameters required for bid process, implementation and final bid review

Prior Accomplishments

- Established project team comprised of owner, vice-president, project manager, scheduler and various crafts as needed.
- Began discussions with owner/customer.
- Began enhanced team development/problem solving strategies.

TASK II: Plan Business Process Review

Accomplishments Oct-Dec95

- Refined a business plan to document the process of ship repair from the time of bid receipt , through the bid process, operations and implementation, and final task analysis of project.

Prior Accomplishments

- Defined business process plan.
- Went aboard the vessel under repair and discussed repairs and opportunities with vessel captain and owner representative.

TASK III: Develop Baseline Models

Accomplishments Oct-Dec95

- Developed baseline models to demonstrate the process of ship repair.

Prior Accomplishments

- Defined specific time elements of scheduling and planning.
- Defined baseline models of ship repair process.

TASK IV: Obtain Simple++ Software

Accomplishments Oct-Dec95

- Established time elements and began simulation of bid process.
- Conducted training session for researchers and ship repair representatives.

Prior Accomplishments

- None.

PROPOSED ACTIVITIES NEXT PERIOD:

TASKS I - III:	Continue work with vendor/owner/supplier in toward cooperative relationships
TASK IV:	Conduct a two day workshop for project team members and supervisor for company
TASK IV:	Complete modeling of ship repair process from bid receipt to project completion
TASK IV - VI:	Complete the simulation of ship repair process
TASK IV & VII:	Gather statistical information, focusing on time and complexity
TASK VIII:	Continue work with project management team for accuracy and completeness
TASK VIII:	Compare and contrast simulation with tasks
TASK IX:	Develop final report

COLLABORATIVE EFFORTS:

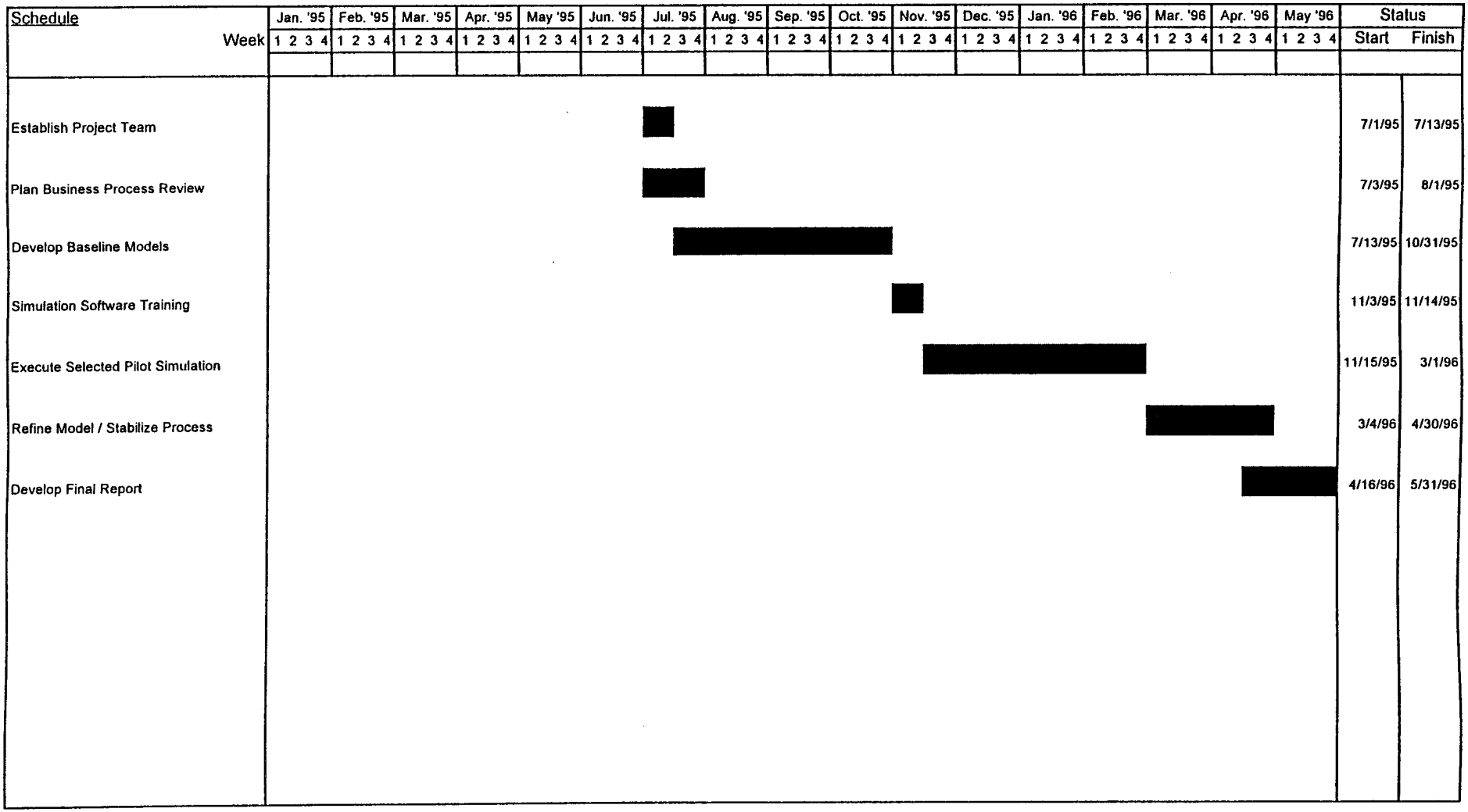
	THIS QTR	YTD
$ VALUE OF SERVICES FROM INDUSTRY:		
Gulf Copper Manufacturing Personnel (Total of 5 persons)		
IN KIND SERVICES:	4,810	13,0675
ACTUAL FUNDS:	N/A	N/A
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:	N/A	N/A
ACTUAL FUNDS:	N/A	N/A

OF SIGNIFICANT CONTACTS:

INDUSTRY:	Gulf Copper Manufacturing, Inc. Stolt Neilson Company
ACADEMIC:	Engineering Faculty and graduate students-Lamar University - Beaumont
GOVERNMENT:	N/A

COMMENTS: The ship repair project was begun with full cooperation of Gulf Copper Manufacturing, Inc., The John Gray Institute, and Gulf Coast Regional Maritime Technology Center, and Lamar University, Orange. Additionally, collaborative efforts were established with the Industrial Engineering Department at Lamar University- Beaumont

Business Process Improvement Project



APPENDIX Q

JAPANESE CIMS TRANSLATION PROJECT

GCRMTC PROJECT NO. OR95-003B

Principle Investigator: **Bruce Bongiorni/Jeevan Campos**
Gulf Cost Region Maritime Technology Center

Lamar University
Orange, Texas 77630

PROJECT SYNOPSIS: In September and October of 1994, Professor Howard M. Bunch of the University of Michigan, and Dr. Vivek Samant of the Orincon Corporation visited Japanese shipyards. During their visit, Professor Bunch and Dr. Samant met with members of the Japanese CIMS initiative at which time they received a copy of the project final report. The report was written in Japanese and was forwarded to ARPA with Professor Bunch's recommendation that it be translated into English and distributed to the SP-4 Panel and ARPA. The Orange site was directed to translate this document. The translation of the report will be useful to the efforts at the Orange site because it deals with the Japanese efforts to develop integrated product models during ship design and automation of shipyards. Additionally, the report will be useful to the SP-4 Design and Production Integration Panel of the Ship Production Committee in developing and prioritizing its projects.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$15,203
FUNDS REMAINING:	($3,528)

ACCOMPLISHMENTS YEAR TO DATE:

TASK I: Obtain copy of document.

Accomplishments Oct-Dec95
- This task was completed in January, 1995.

Prior Accomplishments
- Document received from Government Program Manager.

TASK II: Obtain translation services, proceed with translation, edit the report.

Accomplishments Oct-Dec95
- The draft report has been completely translated and edited including the translation of all charts, graphs, figures, and tables.

Prior Accomplishments
- Obtained translation services from two Japanese students.
- Obtained editing services from English faculty member.

TASK III: Provide draft copy of translated document to Professor Bunch, the SP-4 Panel, and ARPA for review.

Accomplishments Oct. - Dec. 1995

- Distributed a draft of the translated report and the Japanese version to Dr. Robert Latorre of the University of New Orleans; he will conduct a quality audit of the translated version
- A draft copy of the translated document has been distributed to Professor Bunch, Dick Moore of the University of Michigan, and Bob Schaffran of ARPA for their review and comments.

Prior Accomplishments

- Distributed a *pre-draft* version of the translated document to Dick Moore and incorporated his comments and reviews.

PROPOSED ACTIVITIES NEXT PERIOD:

TASK III Upon receipt of Dr. Latorre's evaluation of the quality of the translation, the Orange site will do one of the following:

1) If the translation is of sub-standard value based on Dr. Latorre's evaluation, the Orange site will commit additional funds from it's in-house Project budget category to contract for professional technical translation services.
2. If the translation is acceptable to Dr. Latorre, the Orange site will incorporate comments from all the reviewers and desktop publish a final version for distribution to Professor Bunch (1 copy), the SP-4 panel (10 copies), and ARPA (10 copies).

COLLABORATIVE EFFORTS:

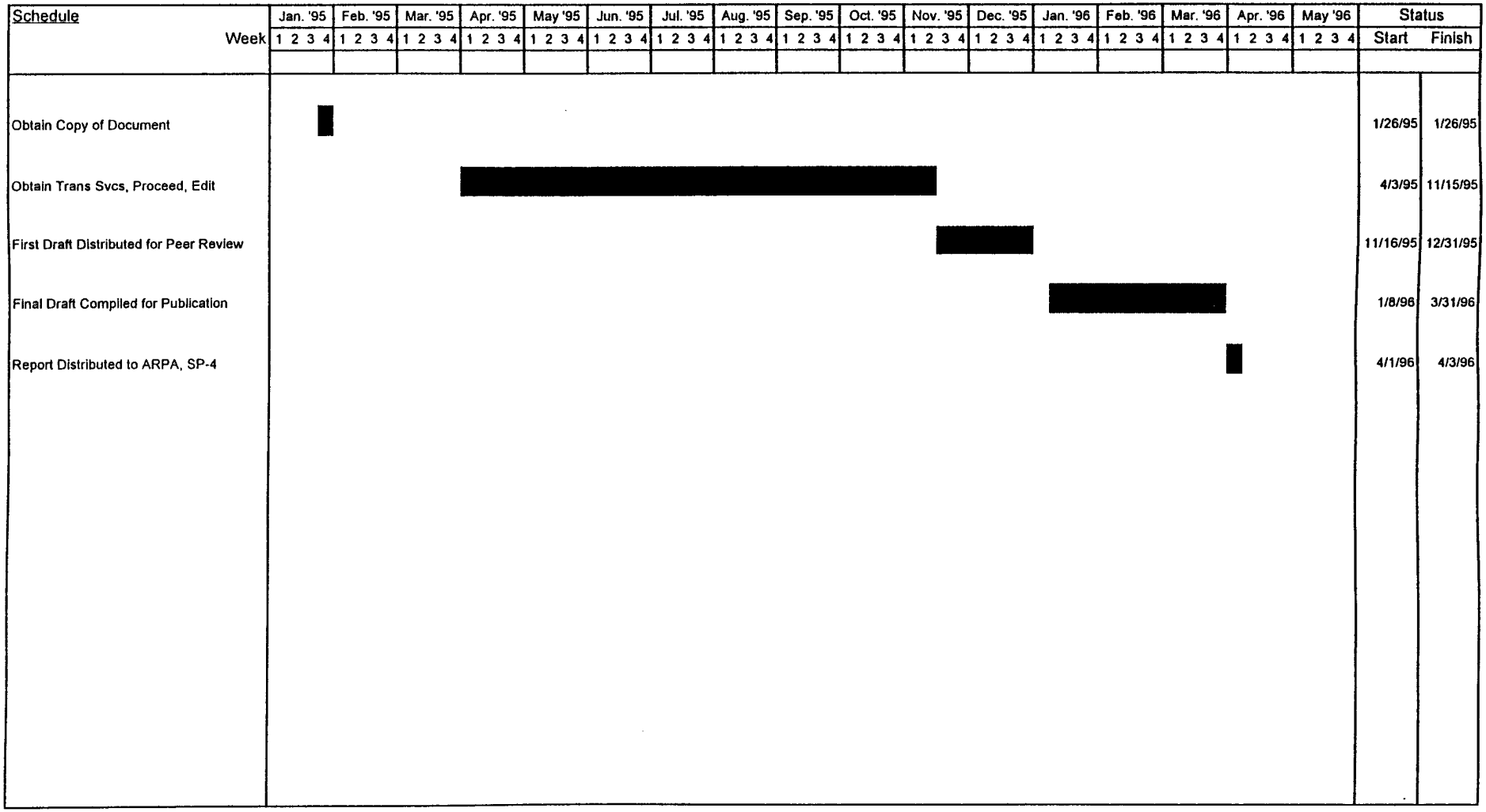
	THIS QTR	YTD
$ VALUE OF SERVICES FROM INDUSTRY:		
Japanese Translator, Terumi Williamson (20 hours @ $30/hour)		
IN KIND SERVICES:	600	600
ACTUAL FUNDS:	N/A	N/A
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:	N/A	N/A
ACTUAL FUNDS:	N/A	N/A

OF SIGNIFICANT CONTACTS:

INDUSTRY:	N/A
ACADEMIC:	N/A
GOVERNMENT:	N/A

COMMENTS: None.

Japanese Translation Project



APPENDIX R

SHIP REPAIR MARKET STUDY

GCRMTC PROJECT NO. OR95 - 002A

Principle Investigator: **Roy Huckaby**
Gulf Cost Region Maritime Technology Center

Lamar University
Orange, Texas 77630

PROJECT SYNOPSIS: This research proposed an extensive analysis of the ship repair market. In addition to providing planning data for Texas Gulf Coast firms, the research will also serve as a model for similar research in other parts of the US. This research will permit US shipyards to become proactive in developing business by identifying 1) the number of and type of potential customers, 2) the factors that will make US Shipyards competitive with respect to both cost and time, and 3) the factors that enter into selection of repair firms, A strategic advantage will ensue. Through a more aggressive marketing of their services, shipyards should become stronger and provide a greater number of permanent jobs for US citizens.

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$132,171
FUNDS REMAINING:	$33,023

ACCOMPLISHMENTS YEAR TO DATE:

TASK I: Literature Search

Accomplishments Oct-Dec95

- Task completed last period

Prior Accomplishments

- Pertinent publication documents from trade associations, government and private sources have been obtained and received. Information has been organized for background information to be included in the completed project report.

TASK II: Identify Shipping/Ship Repair Firms

Accomplishments Oct-Dec95

- AS+ Database received from Lloyds.
- Army Corps of Engineers coastal waterways utilization database received.
- Texas Gulf Coast repair yards identified.

Prior Accomplishments

- Local port authorities were contacted to identify shipping firms utilizing the waterways of the Texas Gulf Coast.
- Shipping lines and appropriate contacts have been identified.

TASK III: Develop/Distribute Surveys

Accomplishments Oct-Dec95

- Surveys distributed to both shippers and repair yards
- Surveys returned to investigators

Prior Accomplishments
- Mail Surveys for both shippers and repair yards has been developed.

TASK IV: Conduct Personal Interviews

Accomplishments Oct-Dec95
- Telephone interviews were conducted with the appropriate personnel.

Prior Accomplishments
- Appropriate contacts in shipping lines and ship repair yards have been made for personal/telephone interviews

TASK V: Analyze Survey Results - Conclusions and Recommendations

Accomplishments Oct-Dec95
- Survey results have been collated and analyzed. Conclusions have been drawn and drafted for inclusion in the final report.

Prior Accomplishments
- None

TASK VI: Draft Report

Accomplishments Oct-Dec95
- Body of report has been drafted in its final format and published for peer review.
- Peer review has taken place and recommendations for changes/additions have been made.

Prior Accomplishments
- First draft of report has been completed.

TASK VII: Present Report

Accomplishments Oct-Dec95
- None

Prior Accomplishments
- None

PROPOSED ACTIVITIES NEXT PERIOD:

TASK V: Prepare extensive list of recommendations of ways for ship repair firms to take advantage of this research. Include recommendation in formal report.

TASK VI: Incorporate comments from peer review. Undergo final review and publish report

TASK VII: Find two venues to present this report. Preferably one local and one national. This will accomplish two things: First, the research will become exposed to the local market for which it was intended. Second, the national presentation will expose the report as a model for other regional research of this type.

PROJECT COMPLETION HAS BEEN DELAYED. IT IS EXPECTED THAT REVIEW COMMENTS CAN BE INCORPORATED AND THE FINAL REPORT BE PUBLISHED BY 16 FEBRUARY 1996.

COLLABORATIVE EFFORTS:

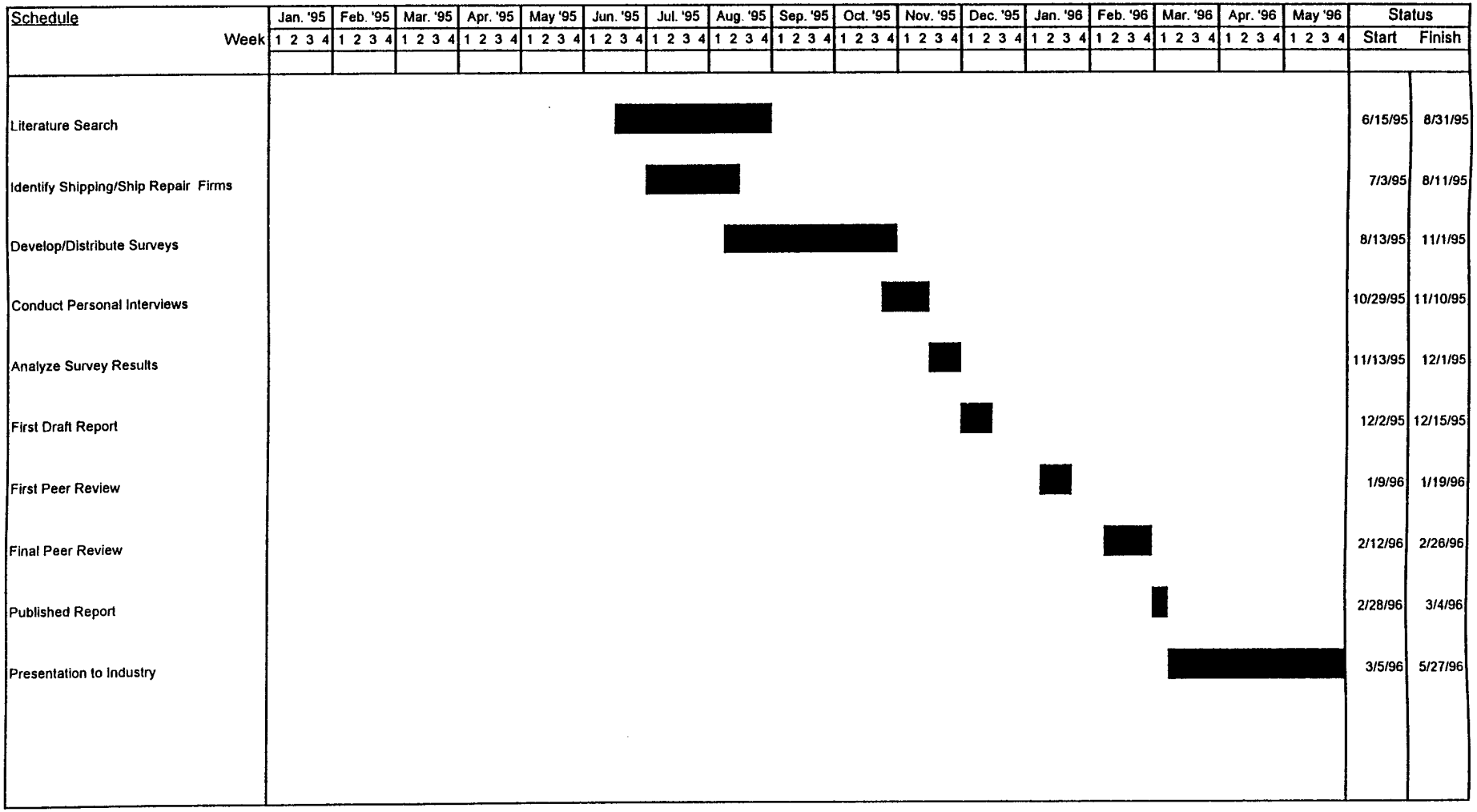
	THIS QTR	YTD
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:	n/a	n/a
ACTUAL FUNDS:	n/a	n/a
$ VALUES OF SERVICES FROM GOVERNMENT:		
IN KIND SERVICES:	n/a	n/a
ACTUAL FUNDS:	n/a	n/a

OF SIGNIFICANT CONTACTS:

INDUSTRY:	n/a
ACADEMIC:	n/a
GOVERNMENT:	n/a

COMMENTS: None

Ship Repair Market Study Project



APPENDIX S

MARKET RESOURCE CENTER FEASIBILITY STUDY

GCRMTC PROJECT NO. OR95 - 005A

Principle Investigator: **Bruce Bongiorni/H. M. Bunch**
Gulf Cost Region Maritime Technology Center

Lamar University
Orange, Texas 77630

PROJECT SYNOPSIS: The purpose of this project is to investigate the feasibility of establishing and operating a market analysis and strategic international marketing center, in cooperation with the US Department of State and the US Maritime Administration, for international commercial shipbuilding sales, including development of curriculum and other materials which can be utilized by the shipbuilding industry.

This study will determine the feasibility of a market analysis and strategic international marketing center for commercial shipbuilding and repair. The center would (1) provide basic marketing data, (2) provide analysis of this data for market identification, (3) prepare training for market analysis, and (4) conduct seminars and colloquia for strategic issues relating to market identification and exploitation.

The study plan has five phases:

1. Project Planning
2. Literature Research and Information Gathering
3. Data Analysis and Concept Evaluations
4. Report Preparation
5. Sponsor Presentations

BUDGET STATUS:

TOTAL AMOUNT BUDGETED:	$134,190
FUNDS REMAINING:	$91,443

ACCOMPLISHMENTS YEAR TO DATE:

TASK I: Project Planning

Accomplishments Oct-Dec95

- The Orange Site has hired a project manager to manage this project.

Prior Accomplishments

- Project scope, including cost, schedule and task identification, has been defined and required resources have been identified
- Professor Howard M. Bunch has been retained to lead in the development and execution of the feasibility study.

TASK II: Literature Research and Information Gathering

Accomplishments Oct-Dec95

- International marketing centers and users of those centers have been identified.
- Contacts within a representative group of these centers and users have been made and interviews have been arranged.
- Resources have been obtained to identify potential clients of a domestic market resource center

Prior Accomplishments

- None

PROPOSED ACTIVITIES NEXT PERIOD:

The project is to the point where it can proceed on two independent tracks, a domestic track and an international track. The purpose of the international track is to interview existing centers that provide clients with marketing resources and/or develop market research studies. The domestic track identifies the potential users of a market resource center and will proceed with interviews of these clients to find the niche(s) that can best serve marketing efforts by those involved in the domestic maritime community.

After interviews are complete, the independent tracks of this project must once again converge. This will allow the appropriate analyses to be done which will include a draft of conclusions and recommendations relating to the feasibility of a domestic market resource center commensurate with the Orange site mission. The tasks anticipated to be completed in the next period are as follows:

TASK III:	Proceed with international interviews.
TASK IV:	Identify domestic set of interviewees.
TASK V:	Proceed with domestic interviews.
TASK VI:	Analyze interview data.
TASK VII:	Prepare conclusions, recommendations and draft report.
TASK VIII:	Sponsor Presentations.

COLLABORATIVE EFFORTS

	THIS QTR	YTD
$ VALUES OF SERVICES FROM INDUSTRY:		
IN KIND SERVICES:	n/a	n/a
ACTUAL FUNDS:	n/a	n/a

$ VALUES OF SERVICES FROM GOVERNMENT:

IN KIND SERVICES:	n/a	n/a
ACTUAL FUNDS:	n/a	n/a

OF SIGNIFICANT CONTACTS:

INDUSTRY:	n/a
ACADEMIC:	n/a
GOVERNMENT:	n/a

COMMENTS: None.

Marketing Resource Center Feasibility Project